A Stereo-Atlas of Ostracod Shells

edited by I. Boomer, D. J. Horne, A. R. Lord, D. J. Siveter, and J. E. Whittaker

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For the purposes of taxonomic priority it should be noted that this issue was actually published on 31 March, 1996, having been delayed beyond the date shown on the cover.

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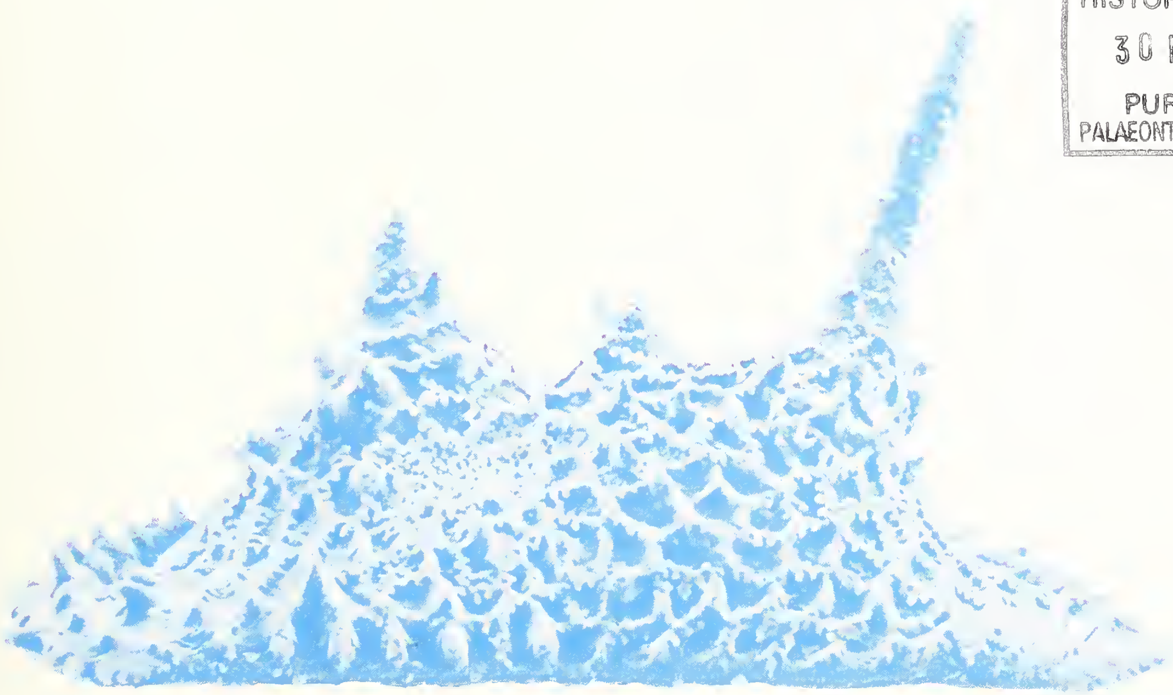

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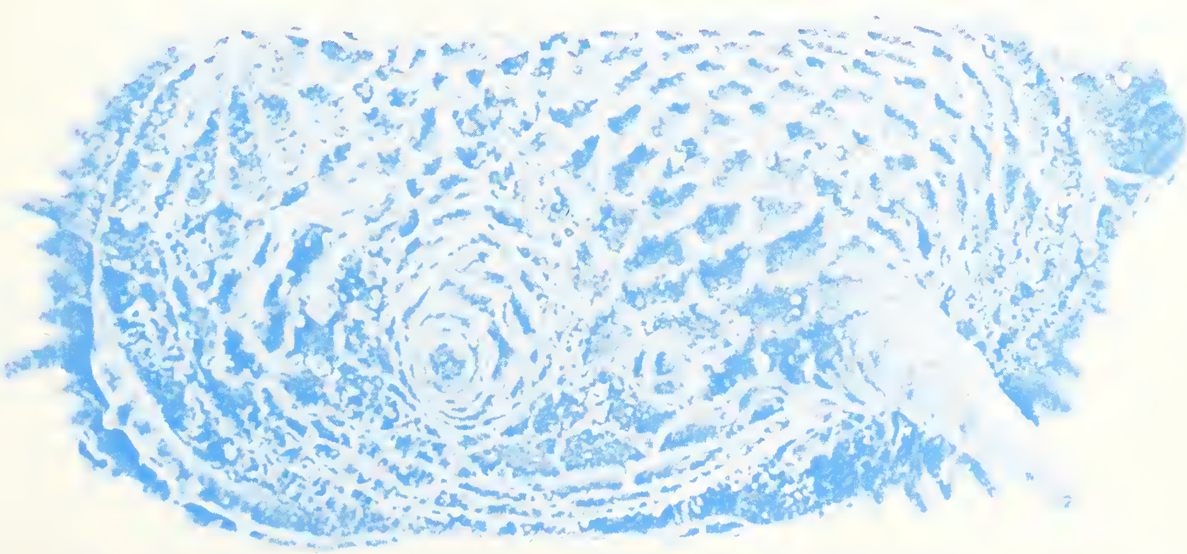

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Instructions to Authors

Contributions illustrated by scanning electron micrographs of Ostracoda in stereo-pairs are invited. All contributions submitted for possible publication in *A Stereo-Atlas of Ostracod Shells* are peer-reviewed by an appropriate international specialist. "Instructions to Authors" and plate blanks for mounting photographs may be obtained from any Editor. Manuscripts should be submitted to Dr Ian Boomer.

The front cover shows (upper) the holotype (RV, dorsal view, BMNH no. **OS 14654**) and (lower) a paratype (LV, external lateral view, BMNH no. **OS 14653**) of *Pariceratina ubiquita* Boomer, 1994 from the Palaeogene of ODP Site 865, Central Pacific Ocean. This species was described in *A Stereo-Atlas of Ostracod Shells*, **21,** 79-86.

ON *BALTOCYAMUS PRIMARIUS* MEIDLA gen. et sp. nov.

by Tõnu Meidla
(Institute of Geology, Estonian Academy of Sciences & Institute of Geology, Tartu University, Estonia)

Genus *BALTOCYAMUS* gen. nov.
Type-species: *Baltocyamus primarius* sp. nov.

Derivation of name: *Balto* (the genus originates from the Baltic area) and *cyamus*, hinting at its bean-like shape (and as used in several primitiopsid names). Gender, masculine.

Diagnosis: Small, strongly convex Anisocyaminae with velum proceeding along entire free margin; male velum bend-like, female differing by posterior concave open dolon. Left valve operlaps right valve along the contact margin.

Remarks: This genus differs from *Clavofabella* Martinsson, 1955 and *Anisocyamus* Martinsson, 1960 by having the velum separated from the lateral surface by a furrow. In addition, it differs from *Primitiopsis* Jones, 1887 in possessing an open dolon in females. *Baltocyamus* is assigned to the Anisocyaminae Martinsson, 1960 based on the lack of distinct S2 and L2.

Baltocyamus resembles the non-dimorphic genus *Pyxion* Thorslund, 1948 in having a flat, wide velum which is similar to the marginal lobe (velum?) of the latter. The contact conditions are the same as *Pyxion posterobicarinatum* Schallreuter (*Stereo-Atlas Ostracod Shells*, **6**, 87–90, 1979): the left valve bears an outer list and inner semi-groove, thus complimenting the marginal structures of the right valve. This condition is the reverse of that in *Anisocyamus elegans* (Harris, 1957) (see Siveter & Williams, *Stereo-Atlas Ostracod Shells*, **15**, 107–114, 1988) or *A. bassleri* (Harris, 1931) (see Siveter & Williams, *Stereo-Atlas Ostracod Shells*, **15**, 115–122,

Explanation of Plate 22, 2

Fig. 1, ♀ car., post (**Os 3292**, 0.77 mm long and 0.36 mm wide). Fig. 2, ♀ car., lt. lat (**Os 3291**, 0.73 mm long). Fig. 3, ♂ car., rt. lat. (holotype, **Os 3178**, 0.78 mm long). Fig. 4, ♀ car., rt. lat. (**Os 3293**, 0.77 mm long). Fig. 5, ♀ car. lt. lat. (**Os 3179**, 0.77 mm long). Fig. 6, juv. car. lt. lat. (**Os 3283**, 0.69 mm long). Fig. 7, ♂ car., post. (**Os 3285**, 0.76 mm long and 0.35 mm wide).
Scale A (250 μm; ×57), figs. 1–7.

1988). In some representatives of the genus *Pyxion* the adductorial sulcus may also be poorly developed (e.g. *P. posterobicarinatum*).

The presence of a distinct velum in both heteromorphs and tecnomorphs of an Anisocyaminae species necessitates modification of the diagnosis for the subfamily.

Baltocyamus primarius sp. nov.

Derivative of name: Latin, *primarius* notable, remarkable, one of the first; alluding to its characteristic, striking ornamentation and to the fact that it is one of the oldest known Anisocyaminae in Baltoscandia.

Holotype: Institute of Geology, Estonian Academy of Sciences, no. **Os 3178**; tecnomorphic carapace.
[Paratypes: Institute of Geology, Estonian Academy of Sciences, nos. **Os 3179–Os 3298**].

Type locality: Tõrremägi, Rakvere, West Viru District, Estonia, approximately lat. 59° 21′ 31″ N, long. 26° 21′ 15″ E; Hirmuse Formation, Oandu Stage, Viruan, Ordovician.

Diagnosis: Carapace small (length up to 0.79 mm), high, strongly convex, slightly postplete with considerably larger anterior cardinal corner. Dorsum epicline. Bend-like velum of male extends along the entire free margin, widening ventrally where it merges with the lateral surface. Female has posterior concave open dolon. Lateral surface irregularly, coarsely-pitted. Left valve overlaps right valve along the contact margin.

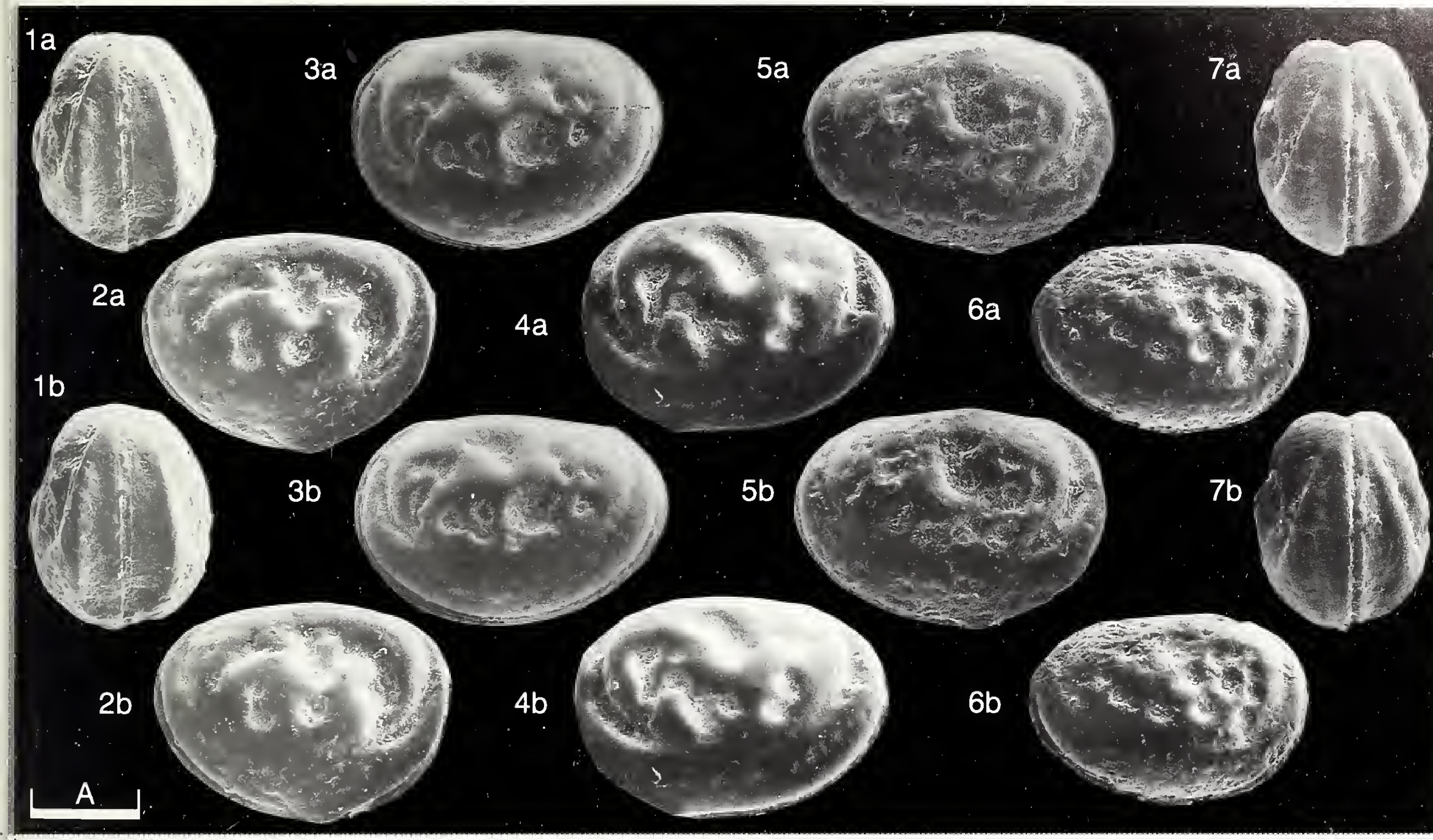
Figured specimens: Institute of Geology, Estonian Academy of Sciences, nos. **Os 3178** (holotype, ♂ car.: Pl. **22**, 2, fig. 3), **Os 3179** (♀ car.: Pl. **22**, 2, fig. 5), **Os 3281** (♀ car.: Pl. **22**, 4, fig. 4), **Os 3283** (juv. car.: Pl. **22**, 2, fig. 6), **Os 3285** (♂ car.: Pl. **22**, 2, fig. 7), **Os 3286** (♂ car.: Pl. **22**, 4, fig. 3), **Os 3288** (♀ car.: Pl. **22**, 4, fig. 7), **Os 3289** (♀ car.: Pl. **22**, 4, fig. 5), **Os 3291** (♀ car.: Pl. **22**, 2, fig. 2), **Os 3292** (♀ car.: Pl. **22**, 2, fig. 1), **Os 3293** (♀ car:. Pl. **22**, 2, fig. 4), **Os 3295** (♂ LV: Pl. **22**, 4, fig. 8), **Os 3296** (♀ RV: Pl. **22**, 4, fig. 1), **Os 3297** (♀ RV: Pl. **22**, 4, fig. 2) and **Os 3298** (♀ LV: Pl. **22**, 4, fig. 6).
All of the figured specimens are from a single sample from the type locality.

Remarks: *B. primarius* is known from about 120 specimens.

Distribution: Known only from the Hirmuse Formation, Oandu Stage, Caradoc Series, Ordovician, at a few localities in the vicinity of Rakvere, Estonia: the Vinni core (depth 43.25 m) and Tõrremägi section.

Explanation of Plate 21, 4

Fig. 1, ♀ RV, int. lat. (**Os 3296**, 0.72 mm long). Fig. 2, ♀ RV, int. lat. (**Os 3297**, 0.70 mm long). Fig. 3, ♂ car., vent. (**Os 3286**, 0.77 mm long). Fig. 4, ♂ car., lt. lat. (**Os 3281**, 0.79 mm long). Fig. 5, ♀ car., vent. (**Os 3289**, 0.73 mm long. Fig. 6, ♀ LV, int. lat. (**Os 3298**, 0.78 mm long). Fig. 7, ♀ car., vent., half-opened (**Os 3288**, 0.76 mm long). Fig. 8, ♂ LV, int. lat. (**Os 3295**, 0.75 mm long).
Scale A (250 μm; ×57), figs. 1–8.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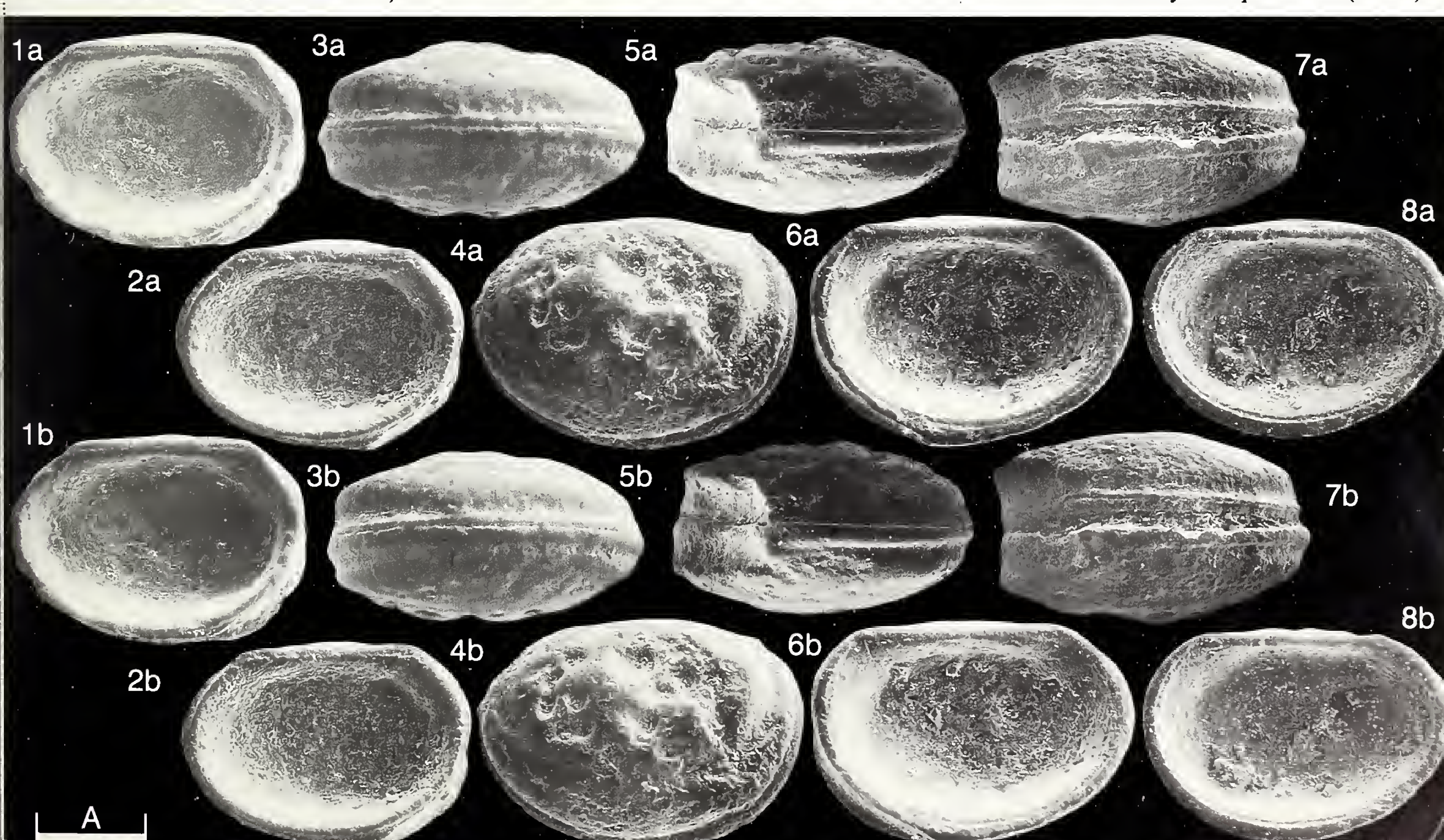
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595.336.21 (113.333) (768 : 162.089.35 + 766 : 162.097.34): 551.351 + 552.54

ON *DIZYGOPLEURA LANDESI* ROTH

by Robert F. Lundin
(Arizona State University, Tempe, U.S.A.)

Dizygopleura landesi Roth, 1929

1929 *Dizygopleura landesi* sp. nov., R. Roth, *J. Paleont.*, **3**, 341, pl. 35, figs. 7a–i.
1965 *Dizygopleura landesi* Roth; R. F. Lundin, *Bull. Okla. geol. Surv.*, **108**, 45.

Lectotype: United States Museum of Natural History (USNM), Washington D.C., U.S.A.; no. **USNM 80645 C**; adult carapace (see Lundin, 1965).

Type locality: The precise locality of the type specimens cannot be established, but it is most likely in the Lawrence Uplift area of Pontotoc County, Oklahoma; approximately lat. 34° 25′N, long. 96° 50′W (see Roth 1929, Lundin 1965, T. W. Amsden, *Bull. Okla. geol. Surv.*, **84**, panel 2, 1960). This locality is probably of late Ludlow or Přídolí Series, Silurian, in age.

Figured specimens: Department of Geology, Arizona State University, (**ASU**), nos. **X-214** (♂ car.: Pl. **22**, 6, figs. 1–3), **X-215** (♀ RV: Pl. **22**, 6, fig. 4), **X-216** (♀ LV: Pl. **22**, 6, fig. 5), **X-217** (♂ LV: Pl. **22**, 8, fig. 1), **X-218** (♀ car.: Pl. **22**, 8, figs. 2–4), **X-219** (♂ LV: Pl. **22**, 8, fig. 5). All figured specimens are adults.

ASU X-214, **ASU X-216**, **ASU X-217** and **ASU X-219** are from approximately 49 m above the base of the Henryhouse Formation in the Lawrence Uplift, Pontotoc County, Oklahoma (Section P3, sample 11 of Lundin 1965). **ASU X-215** is from approximately 12 m below the top of the

Explanation of Plate 22, 6

Figs. 1–3, ♂ car. (**ASU X-214**, 1259 μm long): fig. 1, ext. vent.; fig. 2, ext. dors.; fig. 3, ext. rt. lat. Figs. 4, ♀ RV (**ASU X-215**, 1315 μm long): int. lat. Fig. 5, ♀ LV (**ASU X-216**, 1184 μm long): int. lat.
Scale A (200 μm; ×41), figs. 1–3; scale B (200 μm; ×40), fig. 4; scale C (200 μm; ×43), fig. 5.

Brownsport Formation in the Pope Quadrangle, Perry County, Tennessee; **ASU X-218** is from the middle of the same formation in the Olive Hill Quadrangle, Hardin County, Tennessee. All of these specimens are from the late Ludlow of Přídolí Series, Silurian.

Diagnosis: *Dizygopleura* species with distinct, crescent-shaped L1, weakly bulbous L2 connected ventrally with L3 around slightly angulate S2. L3 and L4 confluent dorsally. L4 carina-like in male, swollen in female. Ventral connection of L1 and L4 more distinct in males than females, carina-like in some male specimens. L2, L3 and the ventral connection of L1 and L4 fused below S2. Distinct peri-marginal carinae on both valves. Left/right overreach strong ventrally.

Remarks: *D. landesi* is distinguished from *D. chaleurensis* Copeland, 1962 (*Bull. geol. Surv. Can.*, **91**, 40) by its larger size, its distinct ventral left/right overreach and by the fusion of L2 and L3 with the connecting lobe.

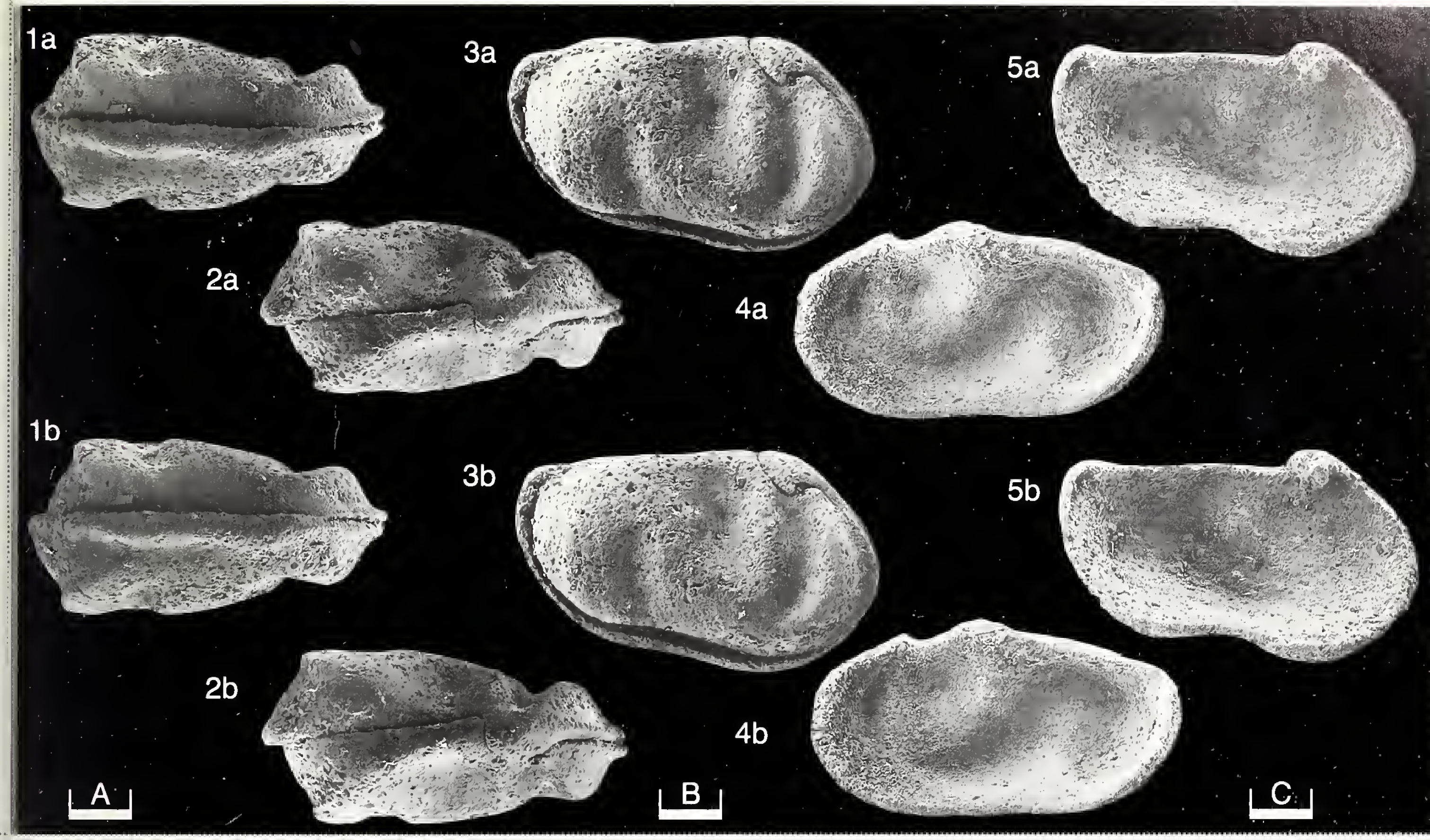
Lundin (1965, 45) described the ontogeny of this species based on a population from the Henryhouse Formation of Oklahoma. This study, in combination with Adamczak's (*Acta palaeont. pol.*, **6**, Text-Pl. 1, 1961) definitive analysis of the ontogeny of *Poloniella* Gürich, makes it clear that these two genera are closely related.

Distribution: With this report of *D. landesi* from the Brownsport Formation, the geographic occurrence of the species is extended from south-central Oklahoma to western Tennessee. The species is known to range from near the base to near the top of the Henryhouse Formation in the Lawrence uplift area of Oklahoma and from 0.6 to 24 m above the base of the Brownsport Formation of western Tennessee. These strata range from middle Ludlow to late Přídolí in age.

Acknowledgement: Support from NATO (Grant 870445) is gratefully acknowledged.

Explanation of Plate 22, 8

Fig. 1, ♂ LV (**ASU X-217**, 1165 μm long): int. lat. Figs. 2–4, ♀ car. (**ASU X-218**, 1240 μm long): fig. 2, ext. dors.; fig. 3, ext. rt. lat.; fig. 4, ext. vent. Fig. 5, ♂ LV (**ASU X-219**, 1240 μm long); int. lat.
Scale A (200 μm; ×44), fig. 1; scale B (200 μm; ×41), figs. 2–5.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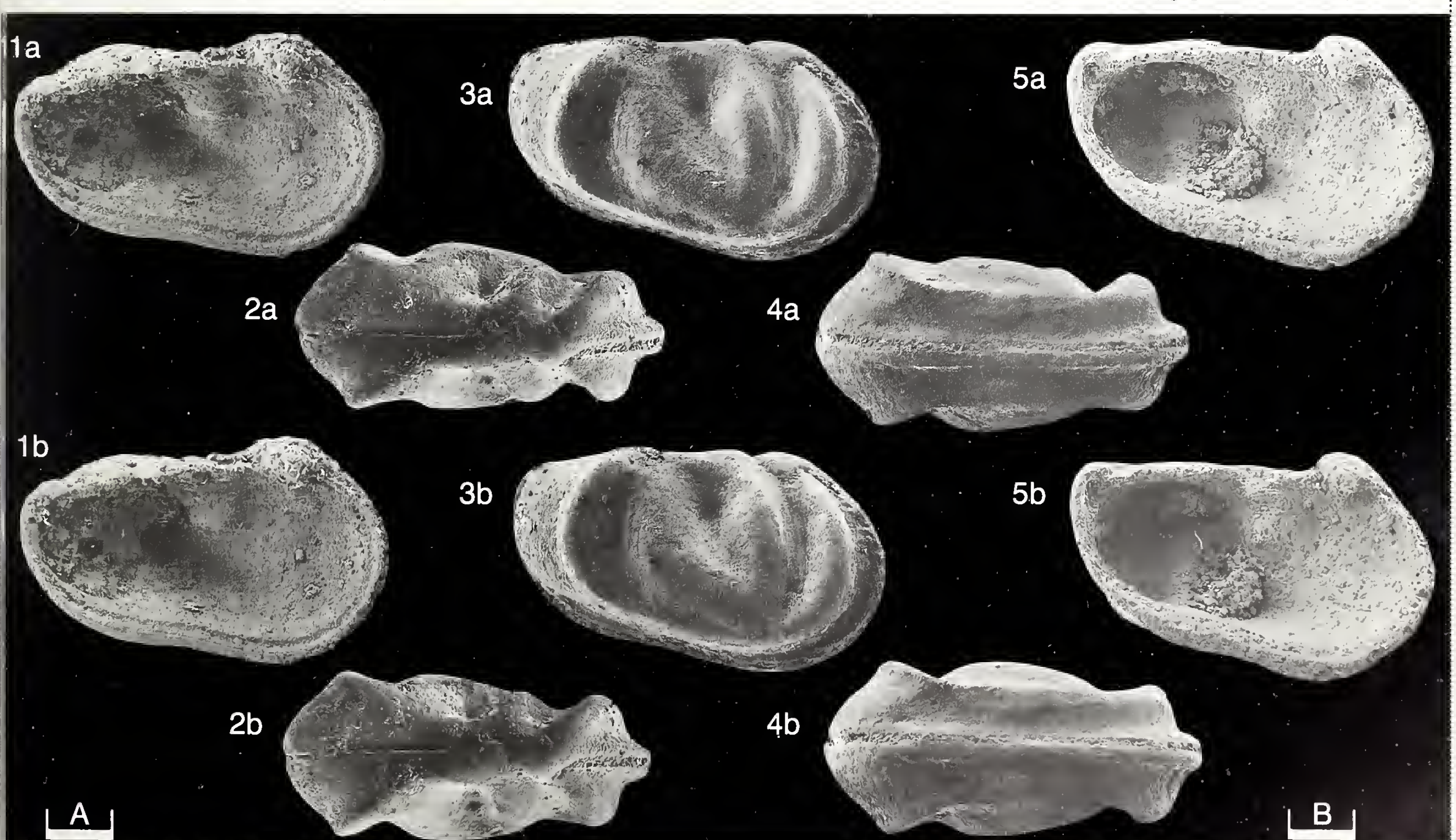
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ON *LONGISCELLA GRANDIS* (JONES & HOLL)

by Lee E. Petersen & Robert F. Lundin
(Anadarko Petroleum Corporation, Houston & Arizona State University, Tempe, U.S.A.)

Longiscella grandis (Jones & Holl, 1869)

1869 *Cytherellina siliqua* (Jones) var. *grandis* Jones & Hall var. nov., T. R. Jones & H. B. Holl, *Ann. Mag. nat. Hist.*, (4), **3**, 217, pl. 14, figs. 1a–c.
1869 *Cytherellina siliqua* (Jones) var. *ovata* Jones & Holl var. nov., T. R. Jones & H. B. Holl, *Ann. Mag. nat. Hist.*, (4), **3**, 217, pl. 14, fig. 4.
1869 *Cytherellina siliqua* (Jones) var. *tersa* Jones & Holl var. nov., T. R. Jones & H. B. Holl, *Ann. Mag. nat. Hist.*, (4), **3**, 217, pl. 14, figs. 3a–c.
1887 *Bythocypris grandis* (Jones & Holl); T. R. Jones, *Ann. Mag. nat. Hist.*, (5), **19**, 185.
1887 *Cytherellina siliqua* var. *ovata* Jones & Holl; T. R. Jones, *Ann. Mag. nat. Hist.*, (5), **19**, 185.
1887 *Cytherellina (Bythocypris?) tersa* Jones & Holl; T. R. Jones, *Ann. Mag. nat. Hist.*, (5), **19**, 191.
1991 *Longiscella grandis* (Jones & Holl); R. F. Lundin, L. E. Petersen & D. J. Siveter, *J. Micropalaeontol.*, **9**, pl. 1, fig. 10.

Lectotype: Designated herein. The Natural History Museum (BMNH), London, England, no. **I 2068**; adult carapace. Jones and Holl (1869) indicated that several specimens were available to them. The lectotype agrees well with the single specimen which they illustrated.

Type locality: Railway tunnel near The Wych, Malvern, England; approximately lat. 52° 05′ N, long. 2° 21′ W. National Grid Ref.: SO 760428. Woolhope Limestone Formation, Sheinwoodian, Wenlock Series, Silurian.

Figured specimens: Department of Geology, Arizona State University, (ASU), nos. **X-133** (adult car.: Pl. **22**, 10, figs. 1–3), **X-258** (adult car.: Pl. **22**, 10, fig. 4; Pl. **22**, 12, fig. 5), **X-259** (juv. car.: Pl. **22**, 10, fig. 5), **X-260** (juv. car.: Pl. **22**, 12, fig. 6.), **X-261** (transverse section of adult car.: Text-fig. 1a), **X-262** (longitudinal section of adult car.: Text-fig. 1b). **BMNH I 2068** (lectotype, adult car.: Pl. **22**, 12, figs. 1–4).

ASU X-133, **ASU X-258**, **ASU X-261** and **ASU X-262** are from the lower part of the Apedale Member, Coalbrookdale Formation at Buildwas Bridge, Shropshire, England (locality 34 of Lundin *et al.*, 1991). **ASU X-259** and **ASU X-260** are from

Explanation of Plate 22, 10

Figs. 1–3, adult car. (**ASU X-133**, 2056 μm long): fig. 1, ext. lt. lat.; fig. 2, ext. rt. lat.; fig. 3, ext. vent. Fig. 4, adult car. (**ASU X-258**, 1953 μm long): ext. dors. Fig. 5, juvenile car. (**ASU X-259**, 959 μm long): ext. rt. lat.
Scale A (300 μm; ×25), figs. 1–3; scale B (300 μm; ×27), fig. 4; scale C (200 μm; ×54), fig. 5.

the upper part of the Buildwas Formation at Buildwas Abbey, Shropshire, England (locality 37 of Lundin *et al.*, 1991). All of these specimens are from approximately lat. 52° 39′ N, 2° 33′ W; the lower to middle Sheinwoodian, Wenlock Series, Silurian.

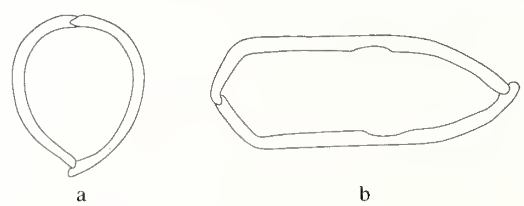
Diagnosis: *Longiscella* species with subreniform lateral outline and subrectangular longitudinal outline. Ventriculus and straguloid processes poorly developed. Adductorial recess distinct. Surface smooth.

Remarks: Comparison of the type specimen of *Cytherellina siliqua* var. *grandis* Jones & Holl with the type specimen of *Longiscella caudalis* (Jones, 1889), the type-species of the thlipsurid *Longiscella* Krandijevsky, indicates that the two species are congeneric. Valve relationships, contact margin features, shape and hingement in the two species are basically alike. We regard the varieties *C. siliqua* var. *tersa* and *C. siliqua* var. *ovata* erected by Jones & Holl (1869, *op cit.*) as synonyms of *L. grandis*, the former being based on a juvenile specimen and the latter being based on a minor shape variant. *Bythocypris holli* var. *oblonga* Jones (*Ann. Mag. nat. Hist.*, (6), 4, 270, 1889), from the upper Llandovery and lower Wenlock of Gotland, is a *Longiscella* species and differs from *L. grandis* in its much smaller size and the greater convexity of the lateral surfaces of its valves.

All of the approximately 40 specimens from England are carapaces (many of which are deformed). Accordingly, the hingement and contact margin structures are interpreted from longitudinal and transverse thin sections of carapaces (Text-fig. 1) and from single valves of the close relative, *L. oblonga* (Jones, 1889).

Distribution: *L. grandis* is known from late Llandovery (upper part of the Purple Shales Formation) to early Wenlock (Buildwas Formation and lower part of the Coalbrookdale Formation), Silurian strata of Britain (Lundin *et al.*, 1991).

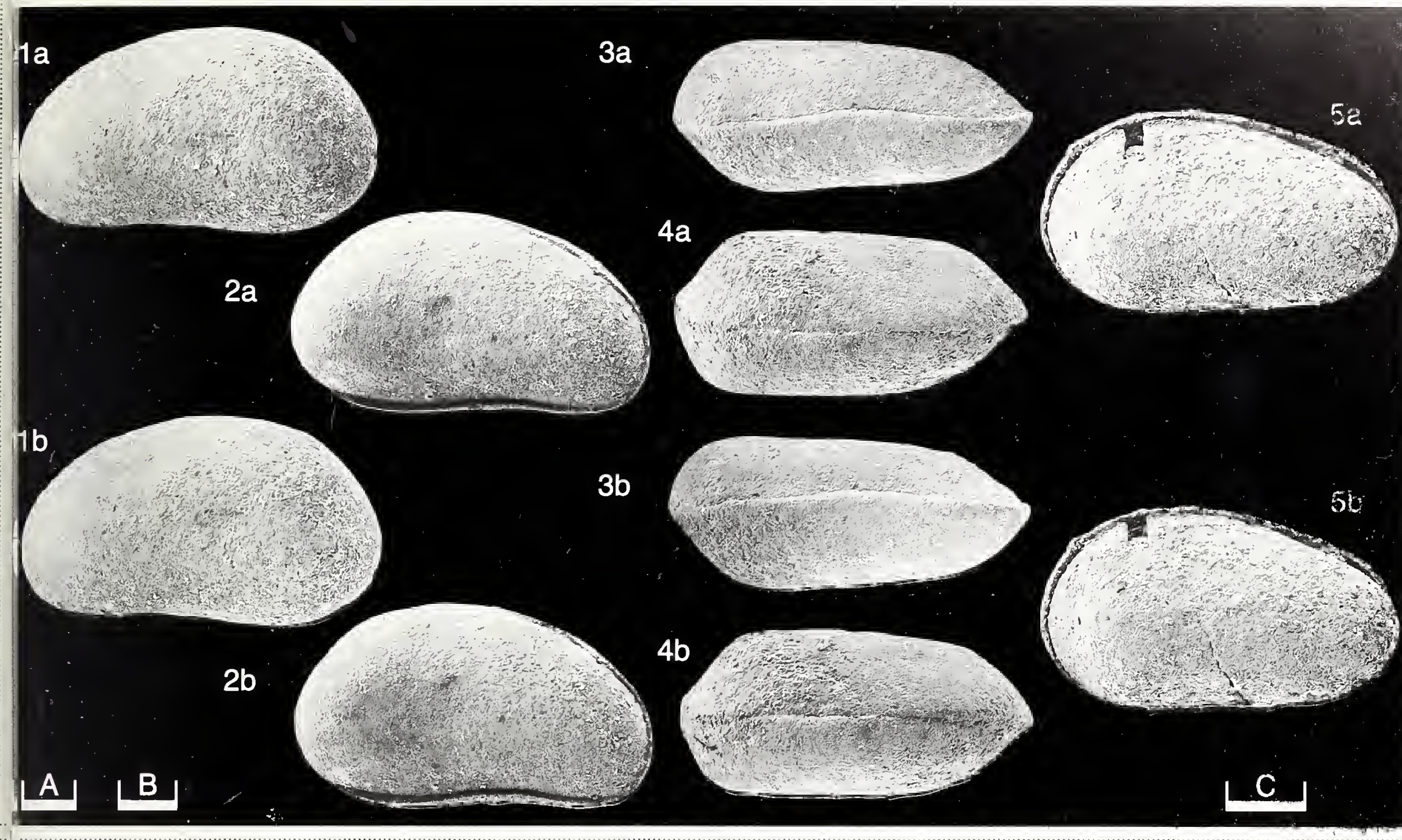
Acknowledgements: We gratefully acknowledge support from NATO (Grant 870445) and the National Science Foundation (Grant EAR-8200816).



Text-fig. 1, Outline drawings from photographs of thin sections of *L. grandis*: 1a, transverse section (**ASU X-261**, anterior view, ×35, 1109 μm high; sample MS 544); 1b, longitudinal section (**ASU X-262**, ventral view, ×34, 2130 μm long; sample MS 541).

Explanation of Plate 22, 12

Fig. 1–4, adult car. (**I 2068**, 1900 μm long): fig. 1, ext. rt. lat.; fig. 2, ext. lt. lat.; fig. 3, ext. dors.; fig. 4, ext. vent. Fig. 5, adult car. (**ASU X-258**, 1953 μm long): ext. rt. lat. Fig. 6, juvenile car. (**ASU X-260**, 1523 μm long); ext. rt. lat.
Scale A (300 μm; ×27), figs. 1–5; scale B (300 μm; ×34), fig. 6.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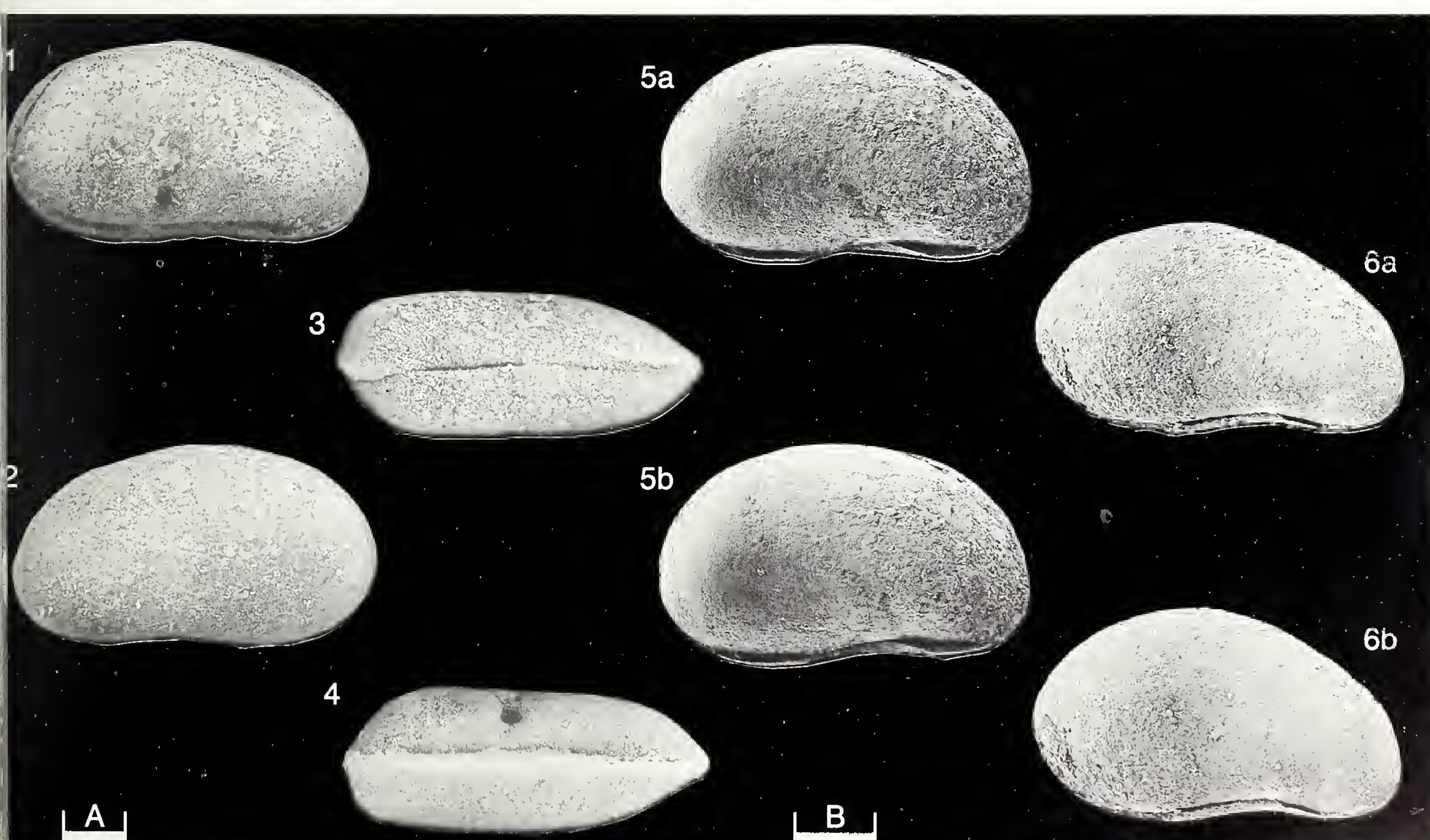
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ON *MICROCHEILINELLA GIGAS* BIRKMANN & LUNDIN sp. nov.

by Harry Birkmann & Robert F. Lundin
(Arizona State University, Tempe, U.S.A.)

Microcheilinella gigas sp. nov.

Holotype: Department of Geology, Arizona State University (ASU), no. **ASU X-263**; adult carapace. [Paratypes: Arizona State University, nos. **ASU X-264–X-267**].

Type locality: Lower part of the cliff section approximately 100 m NNW of point 22, 23 on 5 I Hoburgen SO & 5 J Hemse SV topographic map sheet, Gotland, Sweden (locality Hoburgen IIa of Martinsson, *Bull. geol. Instn Univ. Uppsala*, **41**, 59, 1962). Approximately lat. 56° 55′N, long. 18° 8′E.

Derivation of name: Latin, *gigas*, a giant; referring to the large size of the species.

Figured specimens: Department of Geology, Arizona State University (ASU), nos. **X-263** (holotype, adult car.: Pl. **22**, 14, figs. 1–4; Pl. **22**, 16, fig. 1), **X-264** (paratype, adult car.: Pl. **22**, 16, fig. 2), **X-265** (paratype, juv. car.: Pl. **22**, 16, fig. 3), **X-266** (paratype, adult car.: Pl. **22**, 16, fig. 4), **X-267** (paratype, juvenile RV: Pl. **22**, 16, fig. 5).

ASU X-267 is from the contact between the reef and the overlying bedded limestones, near the top of the cliff at the type section. All of the other figured specimens are from the type locality. All figured specimens are from the Hamra Beds, Ludfordian, Ludlow Series, Silurian.

Diagnosis: Large *Microcheilinella* species with a distinct ventriculus; antero- and postero-lateral surfaces slightly compressed producing a distinctive disk-shaped longitudinal outline. Maximum width at or

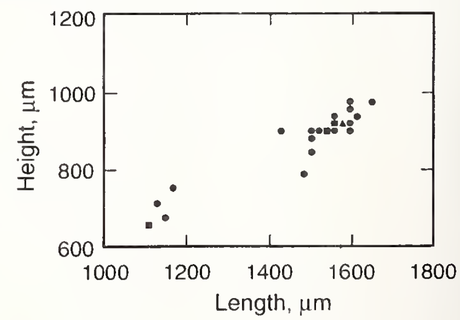
Explanation of Plate 22, 14

Figs. 1–4, adult car. (holotype, **ASU X-263**, 1598 μm long): fig. 1, ext. rt. lat.; fig. 2, ext. dors.; fig. 3, ext. lt. lat.; fig. 4, ext. vent. Scale A (400 μm; ×33), figs. 1–4.

slightly posterior to midlength. Perimarginal carinae on the posteroventral and anteroventral part of admarginal surface of right valve. Anterior admarginal surface of juvenile right valve crenulate. Dimorphic(?) by posteriorward displacement of maximum width in heteromorph.

Remarks: This very distinctive *Microcheilinella* species is characterized by its very large size, the ventriculus, and the perimarginal carinae on the right valve. It differs from all other Pachydomellidae by its distinctive longitudinal outline, which is present in juveniles as well as adults. All known adult specimens are carapaces and, thus, crenulation of the anterior admarginal surface cannot be verified in adults. The length : width ratio of this species is distinctly greater than in species of *Daleiella* Bouček.

Distribution: Known from eight samples at the type locality, ranging from near the base to near the top of the Hamra Beds, Ludfordian, Ludlow Series, Silurian, of Gotland, Sweden.

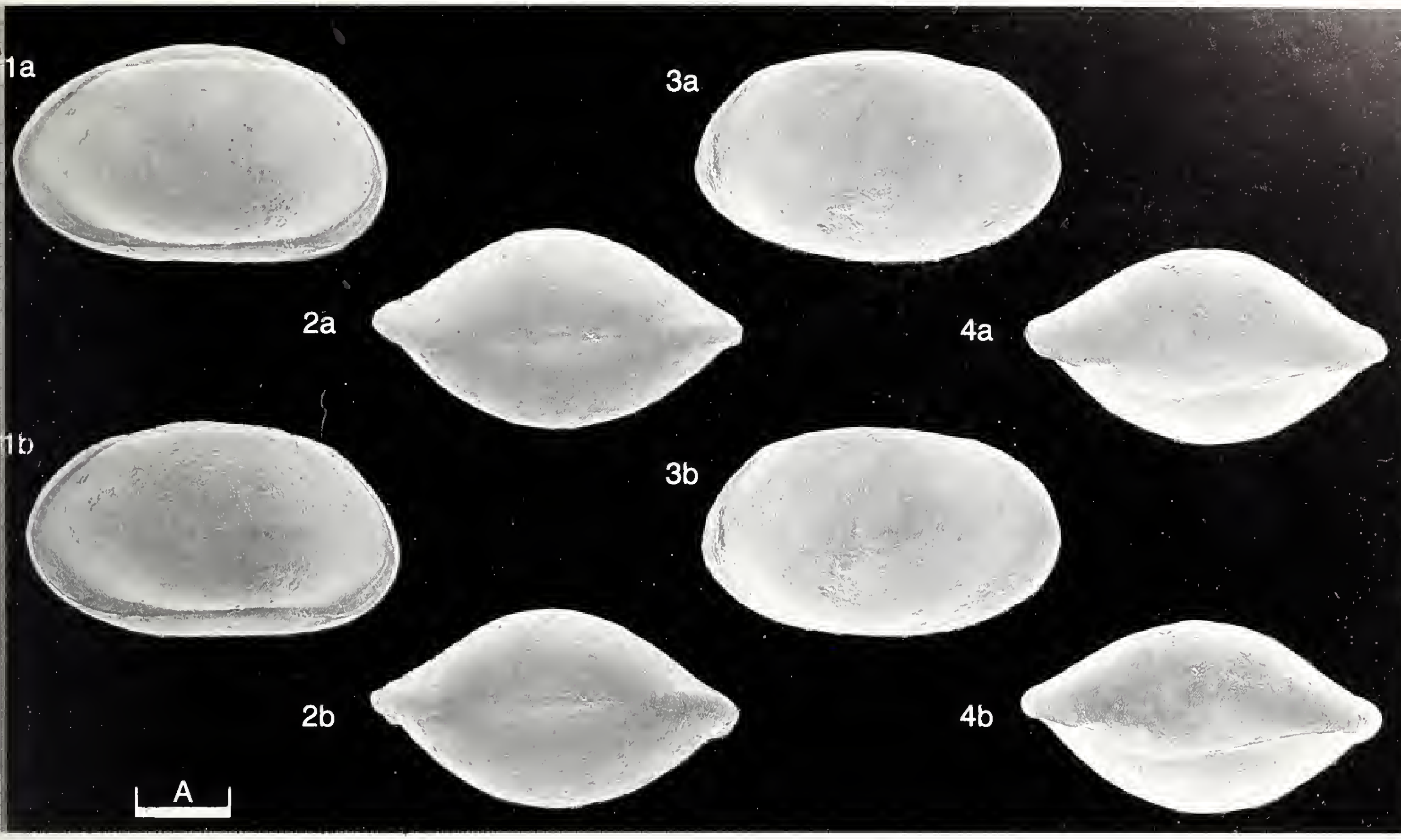


Text-fig. 1. Size dispersion of 21 carapaces from the type locality (Hoburgen IIa, sample MS 2). Triangle = holotype; squares = figured paratypes.

Explanation of Plate 22, 16

Fig. 1, adult. car. (holotype, **ASU X-263**, 930 μm high): ext. ant. Fig. 2, adult car. (paratype, **ASU X-264**, 1541 μm long): ext. rt. lat. Fig. 3, juv. car. (paratype, **ASU X-265**, 1100 μm long): ext. rt. lat. Fig. 4, adult car. (paratype, **ASU X-266**, 1579 μm long): ext. rt. lat. Fig. 5, broken juv. RV (paratype, **ASU X-267**, 1203 μm long): int. of anterior part of valve.

Scale A (400 μm; ×30), figs. 1, 4; scale B (400 μm; ×33), figs. 2, 3; scale C (100 μm; ×106), fig. 5.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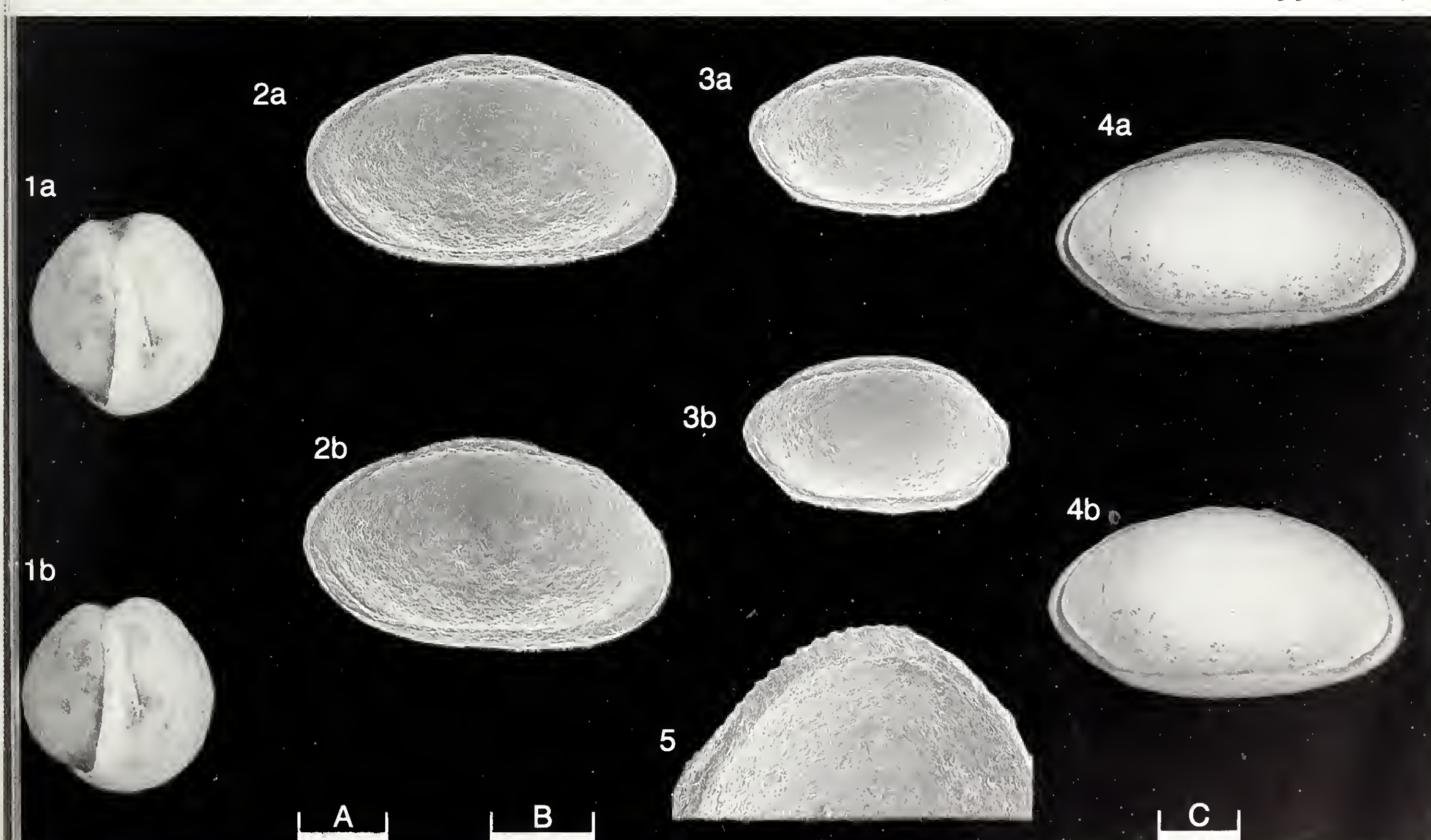
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ON *ORDOVIZONA IMMANIS* BECKER

by Gerhard Becker
(Senckenberg Museum, Frankfurt am Main, Germany)

Ordovizona immanis Becker, 1994

1994 *Ordovizona immanis* sp. nov., G. Becker, *Scr. geol.*, **107**, 8, pl. 1, figs. 1–4.
1994 *Ordovizona immanis* Becker; G. Becker *in* J. E. van Hinte & A. Ruffman, *Scr. geol.*, **107**, pl. 7, figs. 1–5.

Holotype: Nationaal Natuurhistorisch Museum, Leiden, The Netherlands, no. **RGM 414005**; a silicified adult left valve.

Type locality: From seamount 'Orphan Knoll' (see Ruffman, A. & van Hinte, J. E., *Geol. Surv. Pap. Can.*, **71-23**, 407–449, 1973), in the Labrador Sea, approximately 500 km NE of Newfoundland. The material was obtained from a single biologic dredge (LYNCH 7/11/71 cruise, station no. D3-7-11-71) on May 23, 1971, at an average position of 50° 33′ N, 46° 22′ W and from an average depth of 1775 m (see Ruffman, A., *Geol. Surv. Can. Open File*, **2065**, 1989). The specimens of *Ordovizona immanis* come from a single pebble of middle to late Ordovician age.

Figured specimens: Nationaal Natuurhistorisch Museum (**RGM**), Leiden, The Netherlands, nos. **RGM 414005** (adult LV: Pl. **22**, 18, figs. 1, 4; Pl. **22**, 20, fig. 1), **RGM 414006** (adult LV: Pl. **22**, 20, fig. 3), **RGM 414007** (juv. LV: Pl. **22**, 20, fig. 2) and **RGM 414008** (adult LV: Pl. **22**, 18, figs. 2, 3).
All figured specimens are from the type locality.

Diagnosis: Species of *Ordovizona* with a short, straight, ventrally deepened sulcus (S2), a bow shaped dorsal carina, and pronounced costae on the lateral surface which are reduced or absent towards the posterior margin.

Explanation of Plate 22, 18

Figs. 1, 4, adult LV (holotype, **RGM 414005**, 700 μm long): fig. 1, ext. lat.; fig. 4, int. lat. Figs. 2, 3, adult LV (**RGM 414008**, 655 μm long): fig. 2, vent.; fig. 3, ant.
Scale A (200 μm; ×100), figs. 1, 3, 4; scale B (200 μm; ×90), fig. 2.

Remarks: The type-species of *Ordovizona* Schallreuter, 1969 (*Geologie*, **18**, 205), *O. sulcata*, is similar to *O. immanis* in having a subamplete outline, a similar number of costae on the lateral surface (with reticulation developed between the costae) and a distinct dorsal carina and narrow velum. *O. sulcata* differs from *O. immanis* by having a narrower and more clearly defined sulcus (S2) and by the lateral costae which are developed even posteriorly. *Ordovizona longa* Schallreuter, 1983 (*Neues Jb. Geol. Paläont. Mh.*, **1983**, 10, 603) is more elongate than *O. immanis*, has a less distinct sulcus (S2), a less prominent dorsal carina and more numerous but weaker costae on the lateral surface.

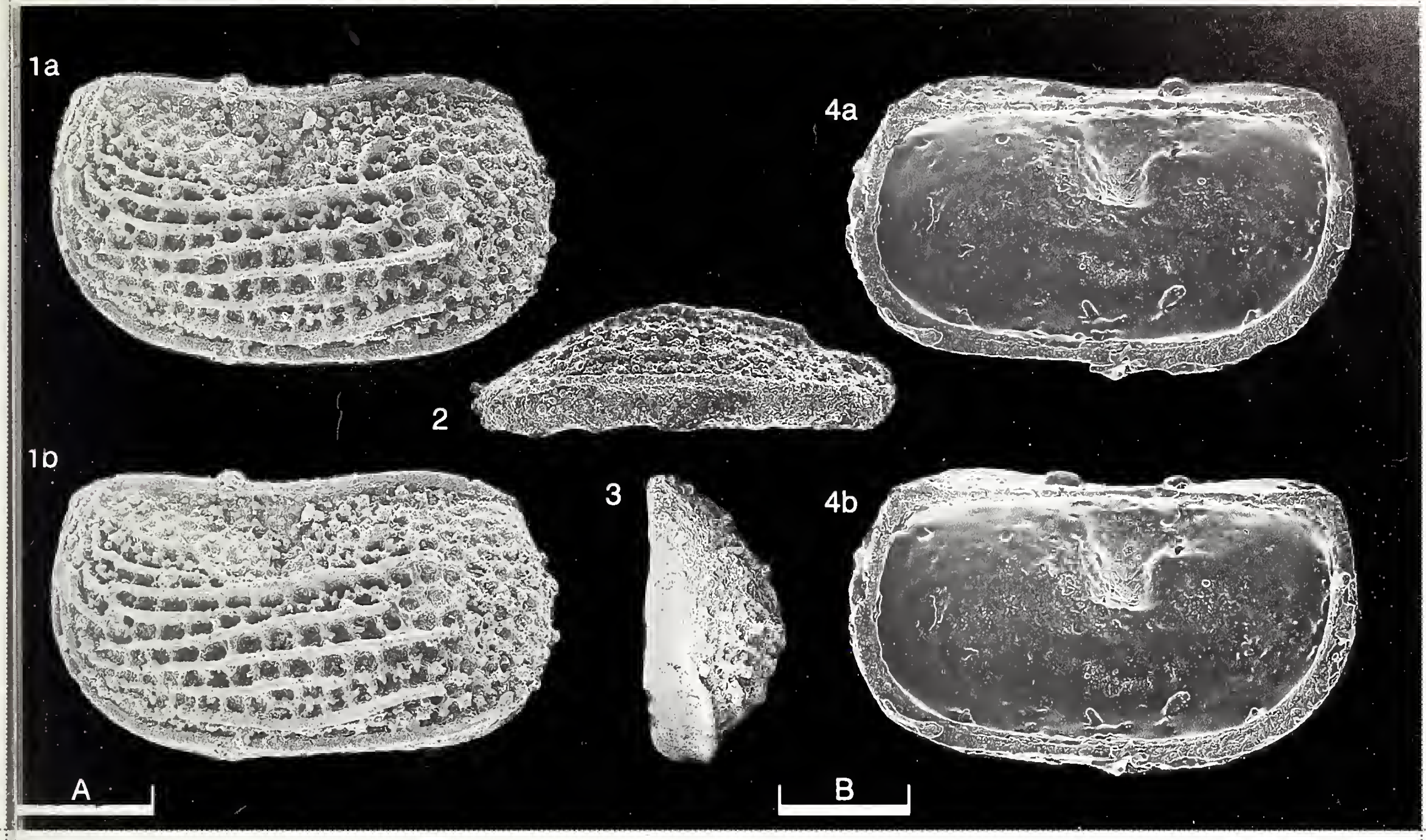
Ordovician forms with a monotiopleurid outline and short, mid-dorsally situated sulcal depressions (e.g. *Ordovizona*) were believed by Schallreuter (*Wiss. Z. Ernst Moritz Arndt-Univ. Greifswald*, **17**, 135, 1968) to be the oldest known members of the Superfamily Kirkbyacea Ulrich & Bassler, 1906. Becker (*Senckenberg. leth.*, **70**, 150, 1990), however, considered them to be related to the Family Kirkbyellidae Sohn, 1961 (Order unknown). Gründel (*Z. geol. Wiss.*, **6**, 74, 1978) suggested that such forms possibly belong to the Family Monotiopleuridae Guber & Jaanusson, 1964 (Superfamily unknown). The early Palaeozoic monotiopleurids and kirkbyaceans *sensu* Schallreuter and the phylogenetically younger kirkbyellids are probably related groups. The Kirkbyacea are a relatively young group with, comparatively advanced carapace architecture; the arcyzonid species *'Amphissites' primaevus* Roth, 1929, from the late Silurian of Oklahoma, U.S.A., is considered by some authors to be the first true kirkbyacean (Becker, G. & Lundin, R. F., *Stereo-Atlas Ostracod Shells*, in press).

O. immanis occurs together with a rich ostracod fauna (see Becker, 1994, 4–9), including species referable to middle to late Ordovician genera such as *Anticostiella* Copeland, 1973 (*Geol. Surv. Pap. Can.*, **72-43**, 9) and *Ectoprimitoides* Berdan, 1988 (*Mem. Bur. Mines Mineral Resourc., New Mex.*, **44**, 278).

Distribution: Known only from the type locality. The material recovered on Orphan Knoll is considered to be from bedrock (Becker, 1994).

Explanation of Plate 22, 20

Fig. 1, adult LV, dors. obl. (holotype, **RGM 414005**, 700 μm long). Fig. 2, juv. LV, dors. (**RGM 414007**, 580 μm long). Fig. 3, adult LV, ext. lat. (**RGM 414006**, 670 μm long).
Scale A (200 μm; ×100), figs. 1–3.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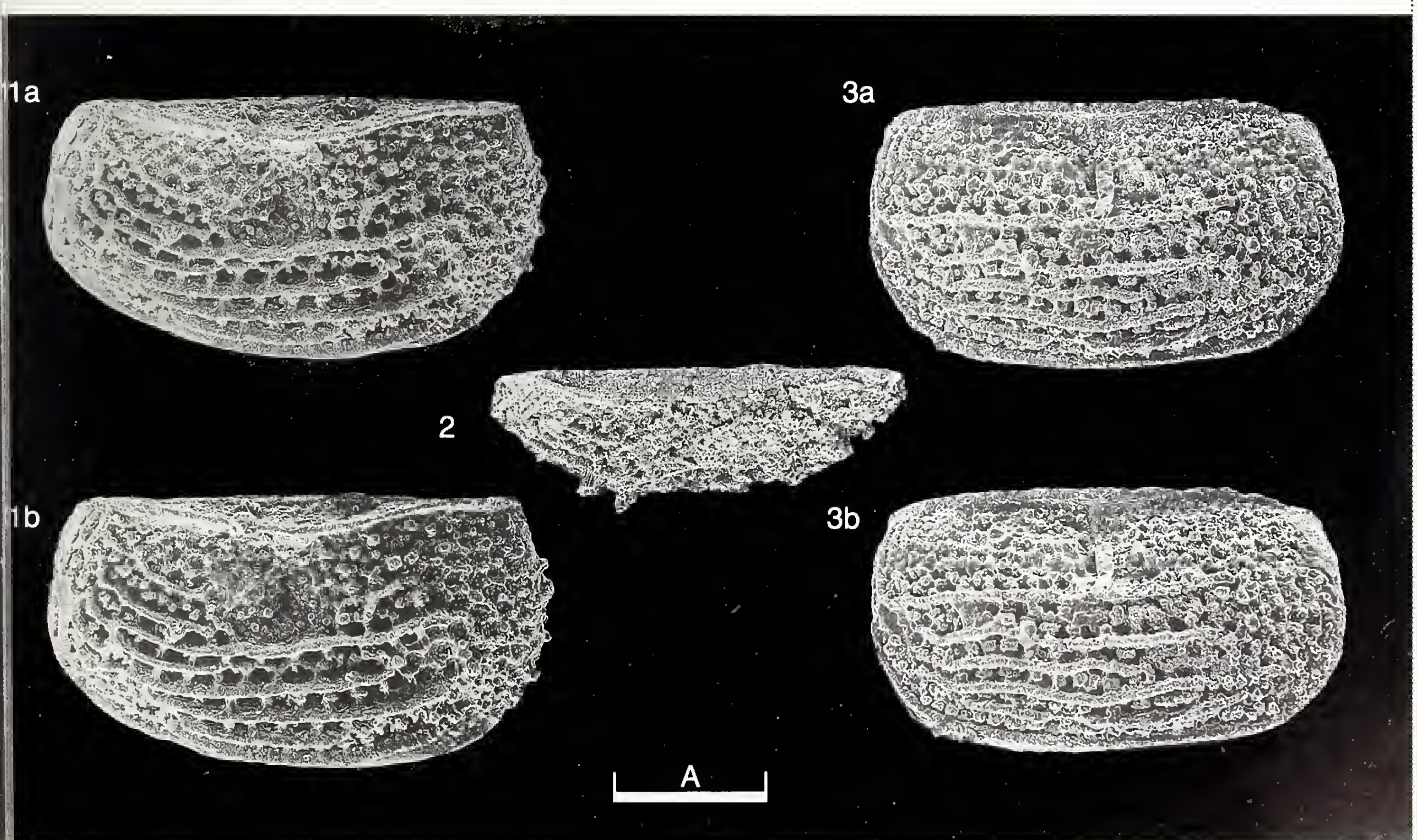
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Stereo-Atlas of Ostracod Shells 22 (6) 21–24 (1995)
595.336 (82: 164.069.30); 551.351 + 552.55

ON *INVERSIBOLBINA LEHNERTI* SCHALLREUTER gen. et sp. nov.

by Roger E. L. Schallreuter
(University of Hamburg, Germany)

Genus *INVERSIBOLBINA* gen. nov.
Type-species: *Inversibolbina lehnerti* sp. nov.

Derivation of name: Latin *inversus* 'turned upside down', plus the generic name *Bolbina*; alluding to the reversal of valve overlap conditions. Gender, feminine.

Diagnosis: Small to medium-size, elongate palaeocope. Unisulcate; short, vertical sulcus (S2) in dorsal half of valve and just in front of mid length. Indistinct, flattish bulb occurs immediately anterior of sulcus. No further special lobes but domicilium generally most inflated in ventrocentral region. Flange-like admarginal ridge in anterior half of valve, narrowing in centroventral region to form a rounded bend (larger valve) or even narrower ridge (smaller valve). Reversal of valve overlap conditions occurs; larger left valve or right valve forms a broad, overlapping vertical flange between the free margin and adventral bend. Surface smooth.

Remarks: The systematic position of the new genus is uncertain. The main adventral sculpture does not seem to be a velum, but rather a differentiated marginal sculpture similar to that in *Eographiodactylus sulcatus* (see Schallreuter, R. E. L., *Stereo-Atlas Ostracod Shells* **7**, 1–8, 1980). The latter differs from *Inversibolbina* by the different construction of its marginal flange, which terminates posteriorly in a long spine.

Explanation of Plate 22, 22

Figs. 1, 2, car. (holotype, **GPIMH 3607**, 835 μm long): fig. 1, ext. rt. lat.: fig. 2, ext. vent. oblique. Fig. 3, car. lt. lat. (**GPIMH 3608**, 884 μm long).
Scale A (250 μm; ×78), figs. 1, 2; scale B (250 μm; ×72), fig. 3.

Stereo-Atlas of Ostracod Shells 22, 23

Inversibolbina lehnerti sp. nov.

Holotype: Geologisch-Paläontologisches Institut und Museum, University of Hamburg, Germany (**GPIMH**), no. **3607**; a carapace.
[Paratype: **GPIMH 3609**].

Type locality: Quebrada de Las Aguaditas, San Jose de Jáchal (Hoja 18c), San Juan, Argentina; approximately latitude 30° 18′S, longitude 68° 48′W. Las Aguaditas Formation, Llanvirn-Caradoc series, Ordovician.

Derivation of name: After Dr Oliver Lehnert, who provided the samples.

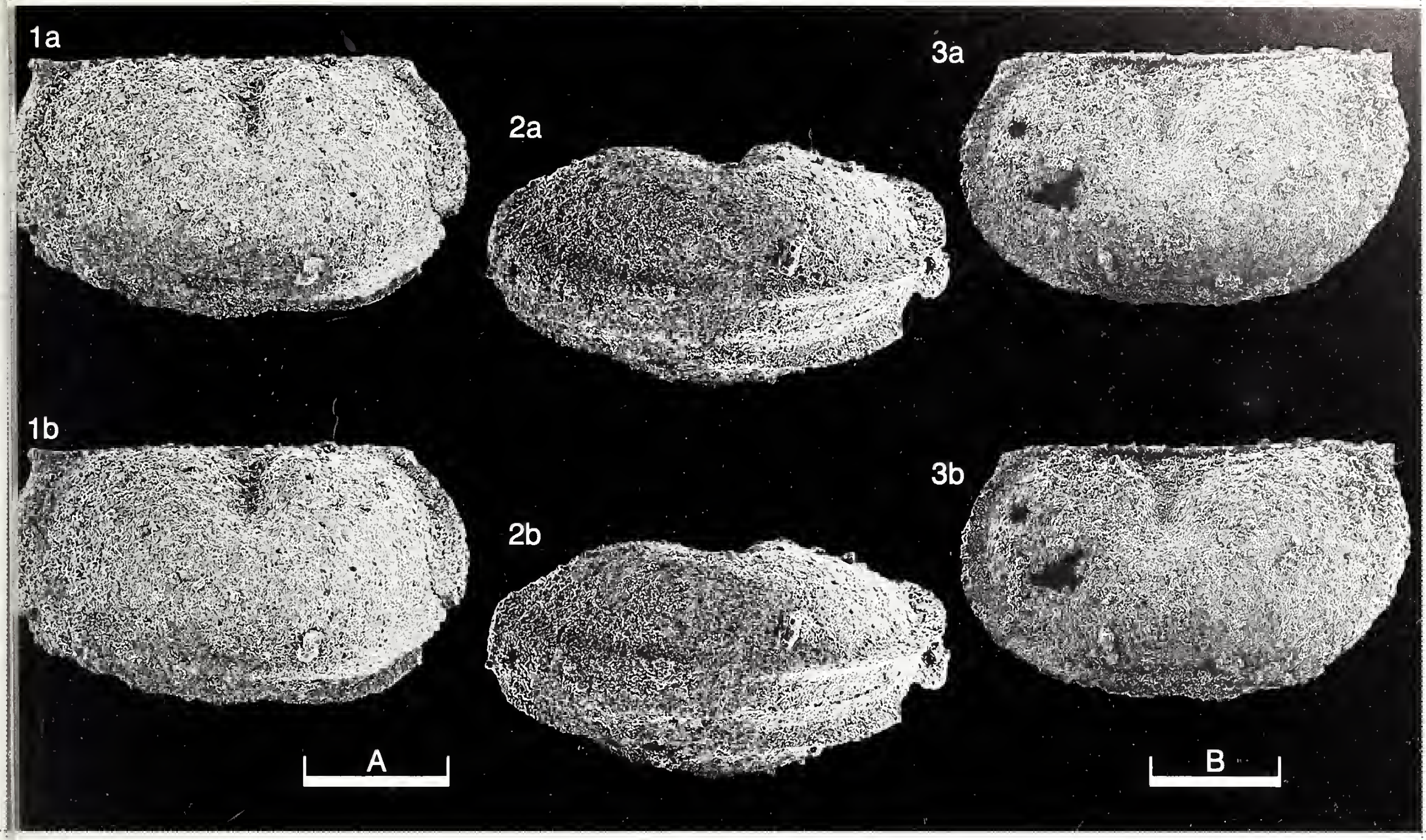
Diagnosis: As for the genus, which is currently monotypic.

Figured specimens: Geologisch-Paläontologisches Institut und Museum, University of Hamburg (**GPIMH**) nos. **3607** (car.: Pl. **22**, 22, figs. 1, 2), **3608** (car.: Pl. **22**, 22, fig. 3; Pl. **22**, 24, fig. 3), and **3609** (car.: Pl. **22**, 24, figs. 1, 2).
All figured specimens are from the type locality and type section of the Las Aguaditas Formation. The specimens are from material collected by Dr Oliver Lehnert: samples SE-CON 51 (specimen **3608**) and SE-CON 46 (all other specimens); *Pygodes anserinus* conodont zone.

Distribution: Known only from type locality, Ordovician of Argentina.

Explanation of Plate 22, 24

Figs. 1, 2, car. (paratype, **GPIMH 3609**, 1012 μm long): fig. 1. ext. vent. oblique; fig. 2, ext. lt. lat. Fig. 3, car. ext. vent. oblique (**GPIMH 3608**).
Scale A (250 μm; ×65), figs. 1, 2; scale B (250 μm ×75), fig. 3.



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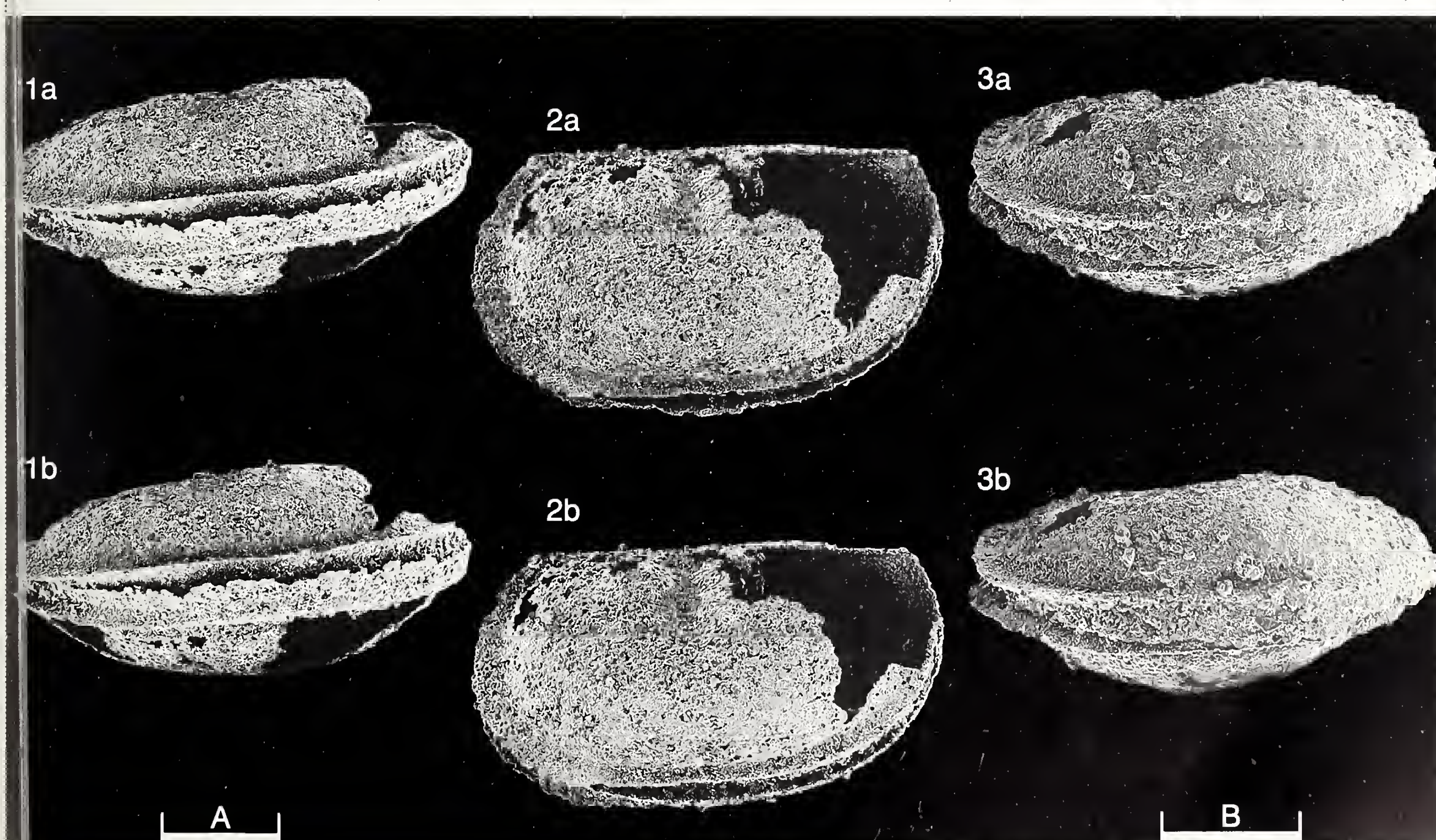

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ON *ARTESIOCYTHERE ARTESICA* KRÖMMELBEIN

by Caroline A. Maybury & Robin C. Whatley
(Institute of Earth Studies, University of Wales, Aberystwyth, U.K.)

Artesiocythere artesica Krömmelbein, 1975

1975 *Artesiocythere artesica* sp. nov., K. Krömmelbein, *Senckenberg. leth.*, **55**, 469-470, pl. 5, figs. 16–17, text-figs. 7–8.

Holotype: BMR (Bureau Mineral Resources) now called AGSO (Australian Geological Survey Organisation), Canberrra no. **CPC 13872**; LV.

Type locality: Borehole Tickalara-1, Great Artesian Basin, SW Queensland, Australia (long. 142°13′E, lat. 28°40′S), 247′0″–248′1″ below surface, Allaru Mudstone, Rolling Downs Group; Albian-Cenomanian.

Figured specimens: AGSO nos. **CPC 13872** (holotype, LV: Pl. **22**, 26, fig. 1; Pl. **22**, 28, figs. 1, 3), **CPC 13873** (paratype, RV: Pl. **22**, 26, figs. 2, 3; Pl. **22**, 28, fig. 2). Paratype from the same borehole as holotype but from 276′3″–277′8½″ below surface.

Diagnosis: *Artesiocythere* with very coarsely reticulate ornament, thick shell and subpyriform shape; with apex of dorsal margin below mid-height. Hinge robustly antimerodont. Radial pore canals straight; 10 anteriorly, 5 posteriorly, the latter concentrated at postero-ventral angle.

Explanation of Plate 22, 26

Figs. 1, LV, ext. lat. (holotype, **CPC 13872**, 630 μm long). Figs. 2, 3, RV (paratype, **CPC 13873**, 600 μm long): fig. 2, ext. lat.; fig. 3, posterior ornament.

Scale A (200 μm; ×95), figs. 1, 2; scale B (50 μm; ×593), fig. 3.

Remarks: This monotypic genus was placed in the Progonocytheridae by Krömmelbein (*op. cit.*) but it clearly belongs in the Cytherideidae, Cytherideinae. The only somewhat similar taxon from the Australian Cretaceous is *Rostrocytheridea westraliensis* (Chapman, 1917) of Neale (J. W. Neale, *Spec. Pap. Palaeont.*, **16**, 39–40, pl. 2, figs. 1–2; pl. 6, fig. 4; pl. 7, figs. 1–3, 1975) but this species is more elongate and has large posterior and postero-ventral spines. Although Kömmelbein in the type description refers to the hingement as 'merodont/entomodont', it is in fact, very robust antimerodont.

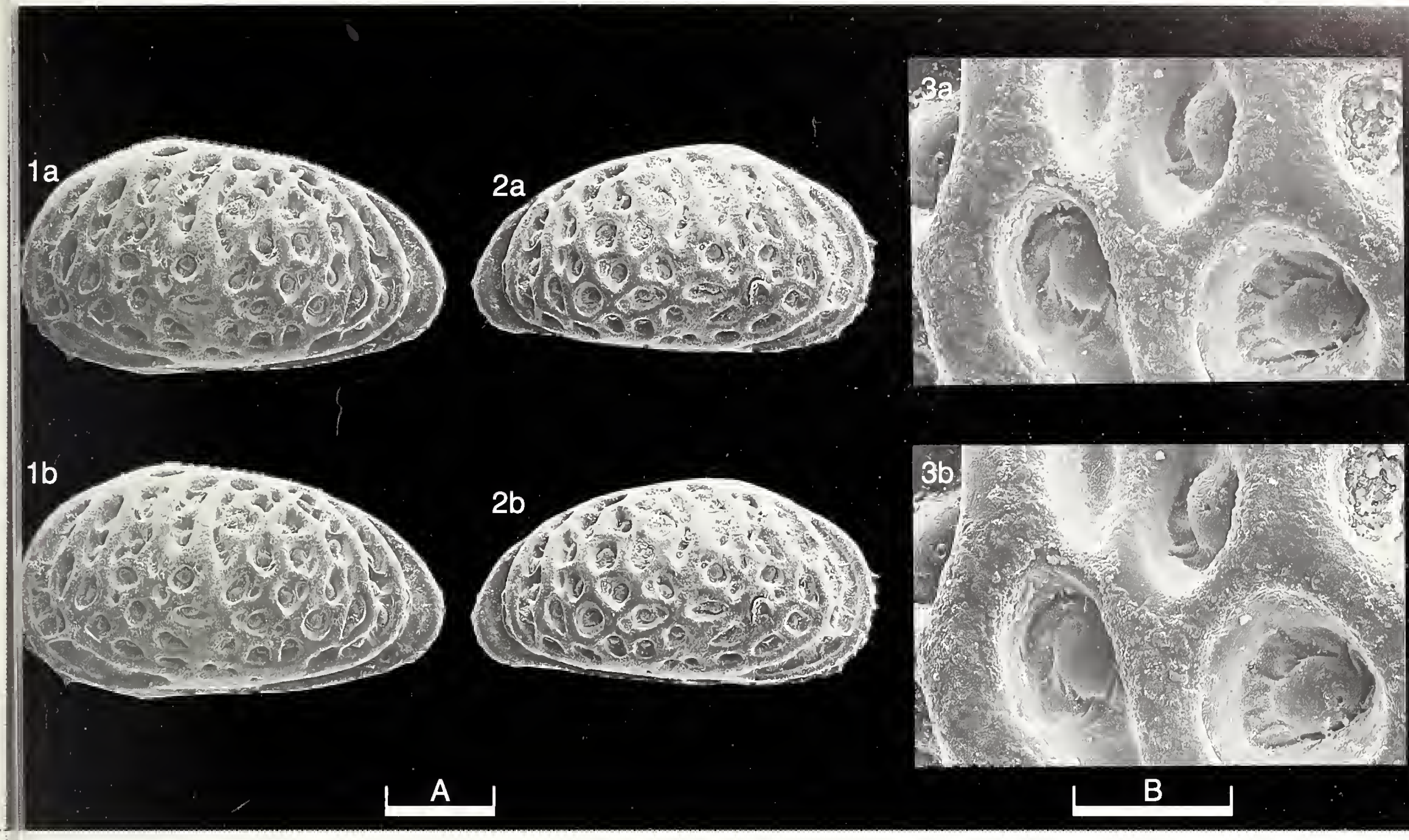
Distribution: This species is known only from the Tickalara Borehole in SW Queensland, Australia.

Acknowledgements: We thank Dr M. A. Ayress (Department of Geology, The Australian National University, Canberra) for photography of Krömmelbein's material.

Explanation of Plate 22, 28

Fig. 1, 3, LV (holotype, **CPC 13872**, 630 μm long): fig. 1, int. lat.; fig. 3, musc. sc. Fig. 2, RV, int. lat. (paratype, **CPC 13873**, 600 μm long).

Scale A (200 μm; ×95), figs. 1, 2; scale B (100 μm; ×294), fig. 3.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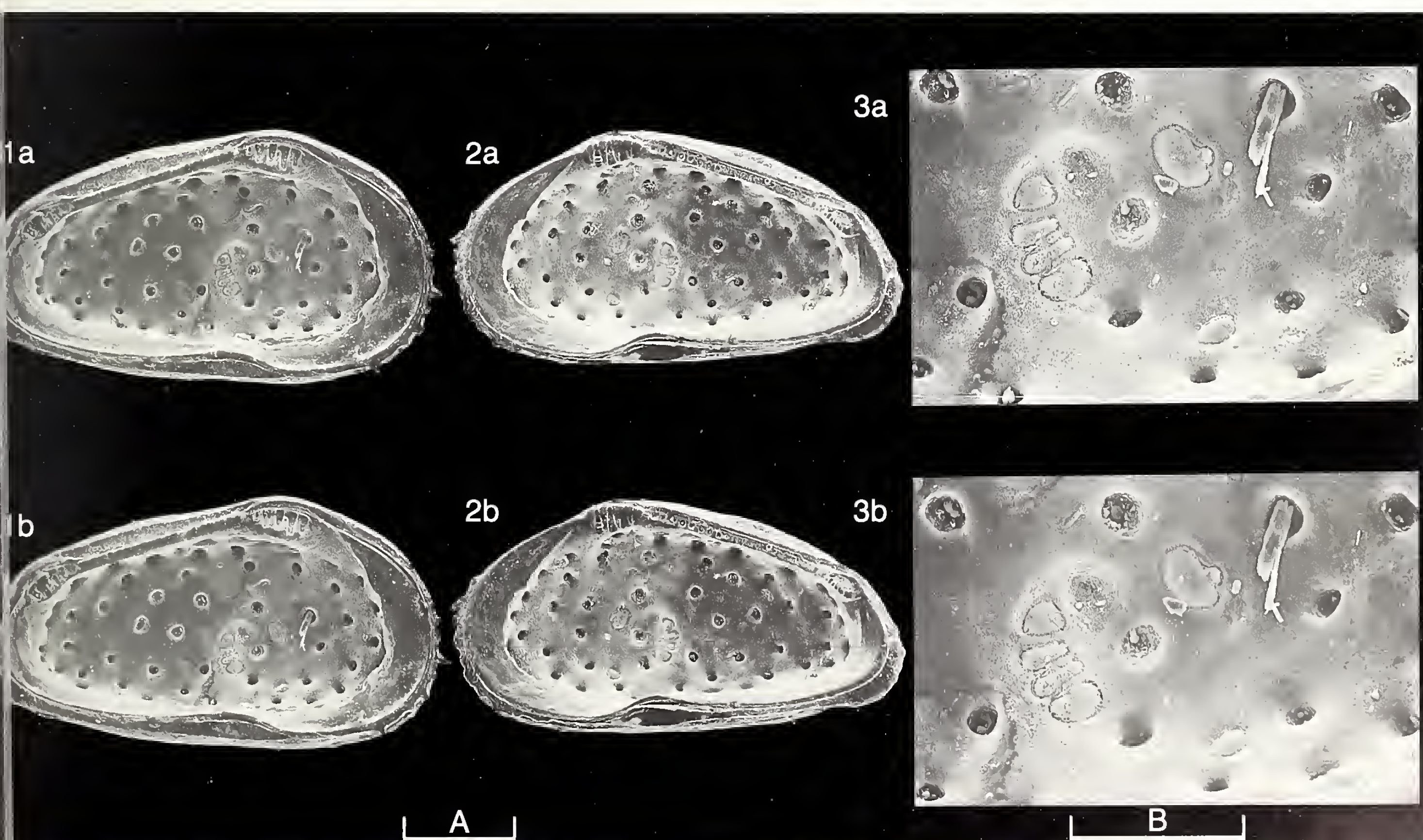
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595.337.14 (116.313 + 116.331) (943 : 163.142.29) : 551.35 + 552.52

ON *ALLARUELLA AUSTRALIENSIS* KRÖMMELBEIN

by Caroline A. Maybury, Robin C. Whatley & Sara Ballent
(Institute of Earth Studies, University of Wales, Aberystwyth, U.K. & University of La Plata, Argentina)

Genus *ALLARUELLA* Krömmelbein, 1975

Type-species (by original designation): *Allaruella australiensis* Krömmelbein, 1975

Diagnosis: A medium, thick-shelled and heavily ornamented cytherurid. Anterior margin broadly and symmetrically rounded; posterior more bluntly so, with apex at about mid-height. Dorsal margin sloping strongly towards posterior, over-reached, particularly in the LV by ornament. Ventral margin with conspicuous oral concavity, overhung medianly by valve tumidity. End margins somewhat compressed. Eye tubercle large and prominent; internal ocular sinus small. Ornament coarsely and very irregularly reticulate and with a series of large hollow tubercles situated sub-centrally, postero-dorsally and postero-ventrally. Strong, almost crest-like vertical ribs occur just in front of the sub-central tubercle, postero-ventrally and on the posterior marginal area. Hinge antimerodont and strongly developed. Calcified inner lamella wide, especially anteriorly where there are (according to Krömmelbein) some 12–17 radial pore canals, with the lower number being characteristic of the RV and the higher of the LV; 6 or 7 radial pore canals occur posteriorly.

Allaruella australiensis Krömmelbein, 1975

1975 *Allaruella australiensis* gen. et sp. nov., K. Krömmelbein, *Senckenberg. leth.*, **55**, 470–472, pl. 2, figs. 8–9, text-figs. 9–10.

Explanation of Plate 22, 30

Figs. 1, ♀ LV, ext. lat. (holotype, **CPC 13878**, 630 μm long). Fig. 2, ♀ RV, ext. lat. (paratype, **CPC 13879**, 600 μm long). Scale A (100 μm; ×150), figs. 1–2.

Holotype: BMR (Bureau Mineral Resources) now called AGSO (Australian Geological Survey Organisation), Canberra no. **CPC 13878**; ♀ LV.

Type locality: Borehole Tickalara-1, Great Artesian Basin, SW Queensland, Australia (long. 142° 13′E, lat. 28° 40′S), 247′0″–248′1″ below surface, Allaru Mudstone, Rolling Downs Group, Albian-Cenomanian.

Figured specimens: AGSO nos. **CPC 13878** (holotype, ♀ LV: Pl. **22**, 30, fig. 1; Pl. **22**, 32, fig. 1), **CPC 13879** (paratype, ♀ RV: Pl. **22**, 30, fig. 2; Pl. **22**, 32, fig. 2). Paratype from same borehole and same level as holotype.

Diagnosis: As for the genus (presently monotypic).

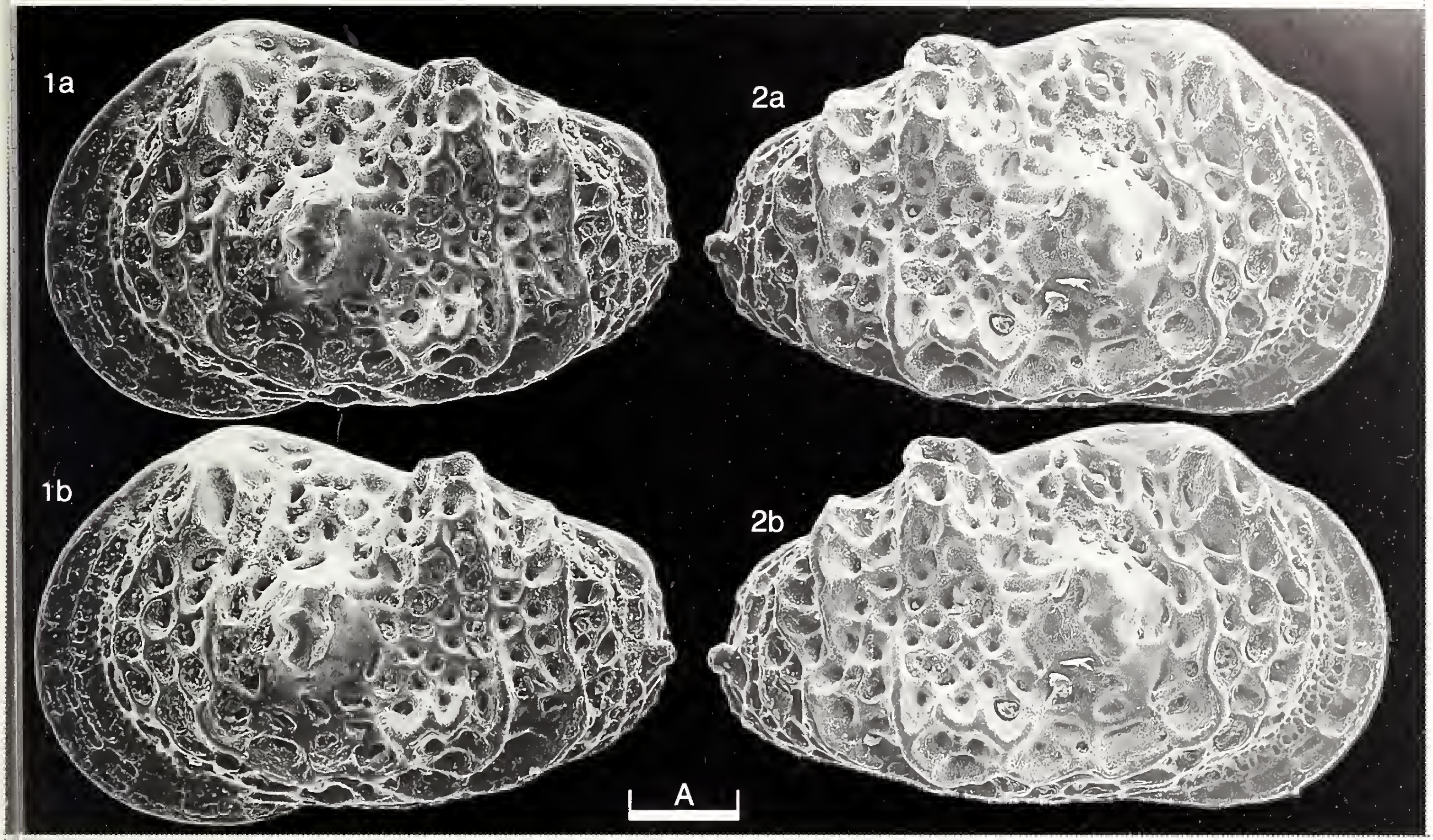
Remarks: The hinge, although described by Krömmelbein (*op. cit.*, 471) as entomodont, is clearly antimerodont. The fact that the illustrated paratype RV has a somewhat broken anterior hinge line could be responsible for this error. The genus seems to be monotypic and not particularly closely related to other taxa. Krömmelbein suggested a similarity with *Orthonotacythere* Alexander, 1933 (C. I. Alexander, *J. Paleont.*, **7**, 199) but the latter genus is more quadrate to sub-rhomboidal in shape. Other Mesozoic cytherurid genera, such as *Trachycythere*, Triebel & Klingler, 1959 (E. Triebel & W. Klingler, *Geol. Jb.*, **76**, 343) are separated by a very large stratigraphical interval (Lower to Middle Jurassic) and *Trachycythere* has an orderly double row of tubercles and is more elongated with a different posterior margin. Some species of *Eucytherura (Vesticytherura)* Gründel, 1964 emend 1981 (J. Gründel, *Mber. dt. Akad. Wiss. Berl.*, **6**, 747, 1964 and *Z. geol. Wiss.*, **9**, 548, 1981) are somewhat similar but have a more sub-dorsal posterior margin and those of *Oligocythereis (=Morkovenicythereis)* Gründel, 1975 (J. Gründel, *Z. geol. Wiss.*, **3**, 368) have much less rugose ornament.

Distribution: Known only from the Albian/Cenomanian of the Tickalara Borehole, SW Queensland, Australia.

Acknowledgements: We thank Dr M. A. Ayress (Department of Geology, The Australian National University, Canberra) for photography of Krömmelbein's material.

Explanation of Plate 22, 32

Fig. 1, ♀ LV, int. lat. (holotype, **CPC 13878**, 630 μm long). Fig. 2, ♀ RV, int. lat. (paratype, **CPC 13879**, 600 μm long). Scale A (100 μm; ×150), figs. 1–2.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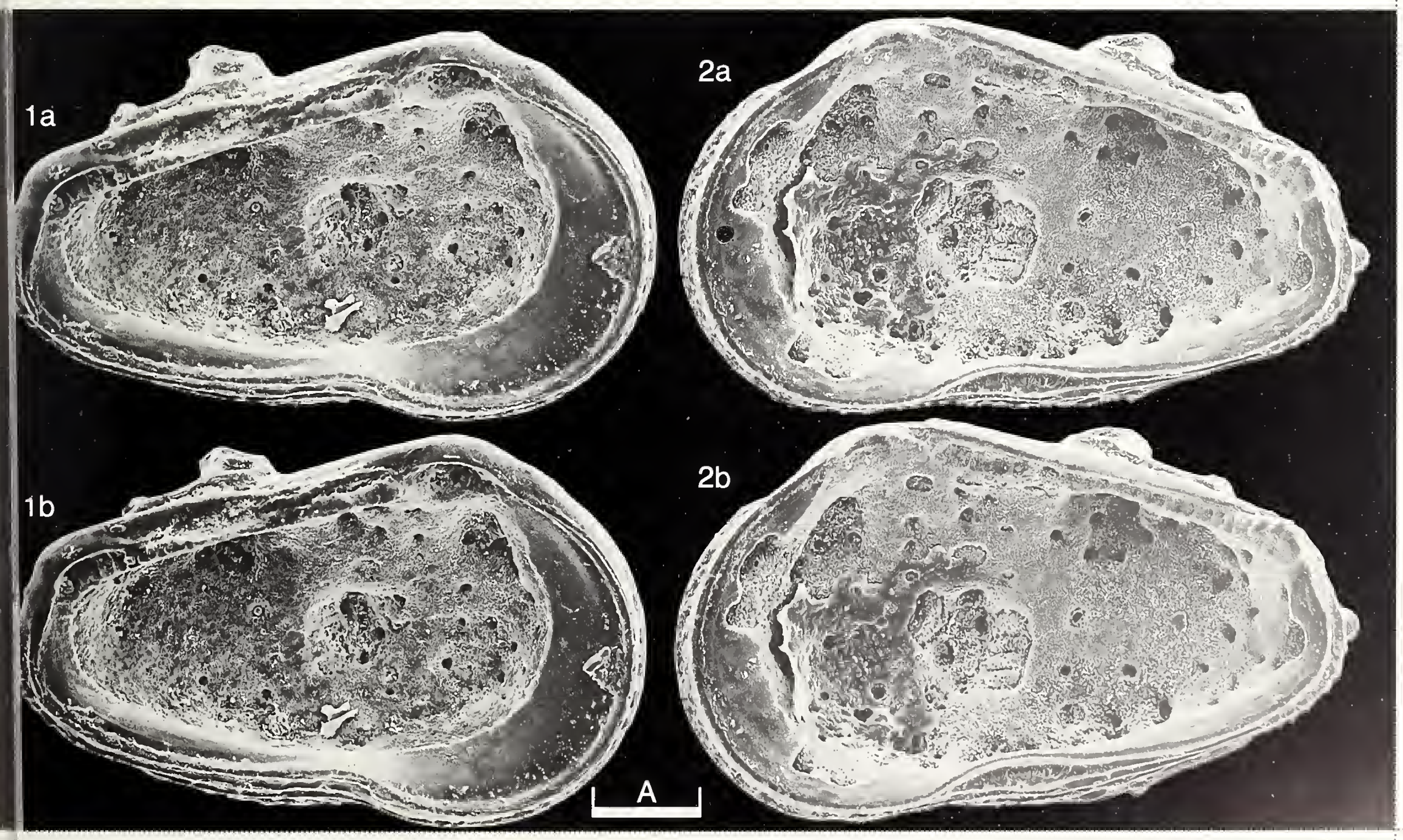
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ON *ARCACYTHERE RUGOSA* MAJORAN sp. nov.

by Stefan Majoran
(Department of Marine Geology, Göteborg University, Sweden)

Arcacythere rugosa sp. nov.

1979 *Arcacythere* sp., K. G. McKenzie, *in:* B. J. Cooper (Ed.), *Rep. Invest. Dept. Mines S. Aust.*, **50**, 93, 94, pl. 1, fig. 9.
1993 *Arcacythere* sp., K. G. McKenzie, R. A. Reyment & E. R. Reyment, *Revta esp. Paleont.*, **8**, 93, pl. 4, fig. 1.

Holotype: Department of Marine Geology, University of Göteborg, Sweden, no. **DMGUG.Au. 68**; LV.

Type locality: Type section of the Blanche Point Formation, near Willunga, South Australia (lat. 35° 15′S, long. 138° 24′E). Late Eocene, Priabonian. Holotype collected 5 m above base of the Perkana Member (dated by planktonic foraminifera as P16, see McGowran *et al.*, 1992 *in:* D. R. Prothero & W. A. Berggren (Eds.), *Eocene-Oligocene Climatic and Biotic Evolution*, Princeton University Press, 178–201).

Derivation of name: Latin *rugosa*, ridged; alluding to the lateral ornament.

Figured specimens: Department of Marine Geology, Göteborg University, nos. **DMGUG.Au. 68** (holotype, adult LV: Pl. **22**, 34, fig. 1), **DMGUG.Au. 69** (adult car.: Pl. **22**, 34, fig. 2), **DMGUG.Au. 70** (juv. A-1 RV: Pl. **22**, 36, fig. 3), **DMGUG.Au. 73** (adult RV: Pl. **22**, 34, fig. 3), **DMGUG.Au. 71** (adult RV: Pl. **22**, 36, fig. 1), **DMGUG.Au. 72** (adult LV: Pl. **22**, 36, fig. 2).

Explanation of Plate 22, 34

Fig. 1, adult LV, ext. lat. (holotype, **DMGUG.Au. 68**, 420 μm long). Fig. 2, adult car., ext. dors. (**DMGUG.Au. 69**, 420 μm long). Fig. 3, adult RV, ext. lat. (**DMGUG.Au. 73**, 415 μm long).
Scale A (100 μm; ×165), figs. 1–3.

All specimens are from type locality: **DMGUG.Au. 69**, **73** from the Tuketja Member; **DMGUG.Au. 71**, from the Gull Rock Member; and **DMGUG.Au. 68**, **70**, **72** from the Perkana Member. (The Blanche Point Formation is divided into the Tuketja, Gull Rock and Perkana members in ascending stratigraphic order).

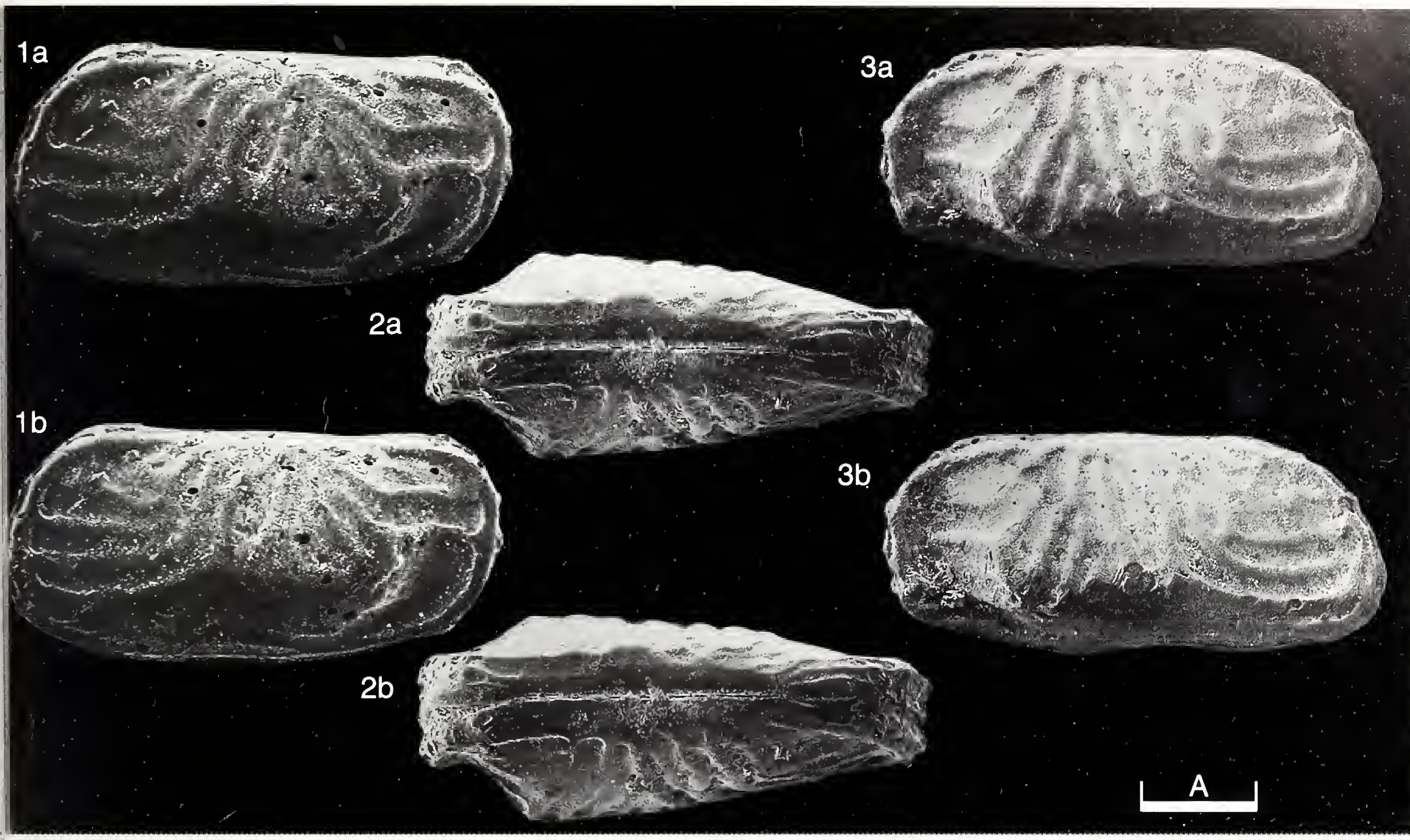
Diagnosis: A non-reticulate species of *Arcacythere* ornamented with conspicuously curved ridges running from the mid-dorsal region towards the anterior and posterior margins. The ventromedian region shows a curved horizontal ridge that forms a median lattice with ascending vertical, slightly inclined ridges. Internal features as for genus.

Remarks: The lateral ornament distinguishes the new taxon from other species of *Arcacythere* (see Hornibrook, 1952, *Palaeont. Bull. Wellington*, **18**, 31–32; Whatley *et al.*, 1982, *J. Micropalaeontol.*, **1**, 1–11; Ayress, 1991, *J. Micropalaeontol.*, **10**, 223–226; McKenzie *et al.*, 1993 (*op. cit.*), although the lateral outline resembles *A. chapmani* Hornibrook, 1952 (*op. cit.*). The new species is very rare in the Blanche Point Formation, only 19 specimens having been recovered, consisting of 15 adults (one carapace and 14 valves) and 4 immature valves (A-1). There is no clear evidence of sexual dimorphism among the adults.

Distribution: Presently known from the Tuketja, Gull Rock and Perkana members of the Blanche Point Formation, South Australia (Late Eocene, Priabonian, Zone P16). Also from the Middle? Eocene, below the Johanna River Greensand Member at Browns Creek, Victoria, and in the Browns Creek Clays (Late Eocene) at Browns Creek (see McKenzie *et al.*, 1993).

Explanation of Plate 22, 36

Fig. 1, adult RV., int. lat. (**DMGUG.Au. 71**, 420 μm long). Fig. 2, adult LV, int. lat., musc. sc. (**DMGUG.Au. 72**); Fig. 3, juv. A-1 RV, ext. lat. (**DMGUG.Au. 70**, 380 μm long).
Scale A (100 μm; ×165), figs. 1, 3; scale B (10 μm; ×565), fig. 2.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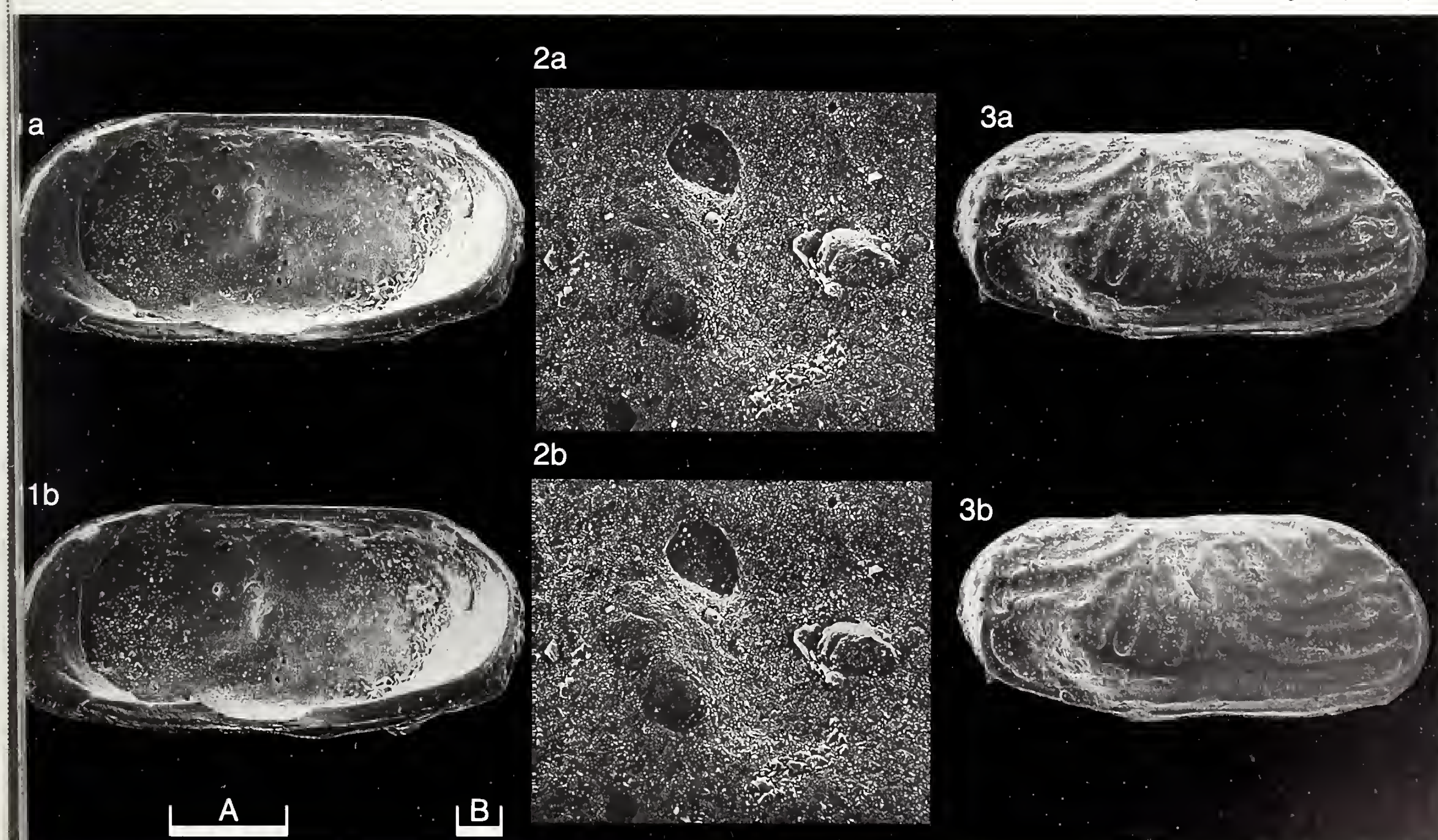
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ON *KUIPERIANA PARAVARIESCULPTA* MAYBURY sp. nov.

by Caroline A. Maybury
(Institute of Earth Studies, University of Wales, Aberystwyth, U.K.)

Kuiperiana paravariesculpta sp. nov.

1989 *Kuiperiana variesculpta* (Ruggieri); R. C. Whatley & C. Maybury *in:* J. Fourniguet, F. Trautmann, J.-P. Margerel, R. C. Whatley, C. Maybury & M. T. Morzadec-Kerfourn, *Geol. Fr.*, **1989** (1–2), 72 (list) (*non Loxoconcha variesculpta* Ruggieri, 1962).

Holotype: The Natural History Museum, London [BMNH] no. **OS 14647**, ♂ LV. [Paratypes nos. **OS 14648–14652**].

Type locality: Sample no. 29, Vicarage Pit, St. Erth, Cornwall, England (5°26′W, 50°10′N; Nat. Grid Ref. SW 556352); Upper Pliocene.

Derivation of name: Latin referring to the similarity of the new species to *Kuiperiana variesculpta* (Ruggieri, 1962) (*Palaeontogr. ital.*, **56** (26), 58, pl. 7, figs. 12–13, text-fig. 13).

Figured specimens: The Natural History Museum, London [BMNH] nos. **OS 14647** (holotype, ♂ LV: Pl. **22**, 38, fig. 1), **OS 14648** (paratype, ♂ RV: Pl. **22**, 38, fig. 2), **OS 14652** (paratype, ♀ LV: Pl. **22**, 38, fig. 3), **OS 14651** (paratype, ♂ car: Pl. **22**, 40, fig. 1), **OS 14649** (paratype, ♂ LV: Pl. **22**, 40, Fig. 2), **OS 14650** (paratype, ♂ RV: Pl. **22**, 40, figs. 3, 4). All paratypes are from the same sample as the holotype, with the exceptions of paratype **OS 14652** which is from sample no. 23, but from the type locality and horizon (see C. A. Maybury, *Taxonomy, Palaeoecology and Biostratigraphy of Pliocene Benthonic Ostracoda from St. Erth and NW France*, unpub. PhD thesis, Univ. Wales, **1**, 3–6, 1985 for further sample details) and paratype **OS 14651** which is from Falleron, NW France (1°45′W, 46°50′N) (see J.-P. Margerel, *Les Foraminifères du Redonien. Systématique, Répartition stratigraphique, Paléoécologie*, Nantes, **1**, 8–26, 1968 for further sample details).

Explanation of Plate 22, 38

Fig. 1, ♂ LV, ext. lat. (holotype, **OS 14647**, 510 μm long). Fig. 2, ♂ RV, ext. lat. (paratype, **OS 14648**, 510 μm long). Fig. 3, ♀ LV, ext. lat. (paratype, **OS 14652**, 410 μm long).
Scale A (100 μm; ×123), figs. 1–3.

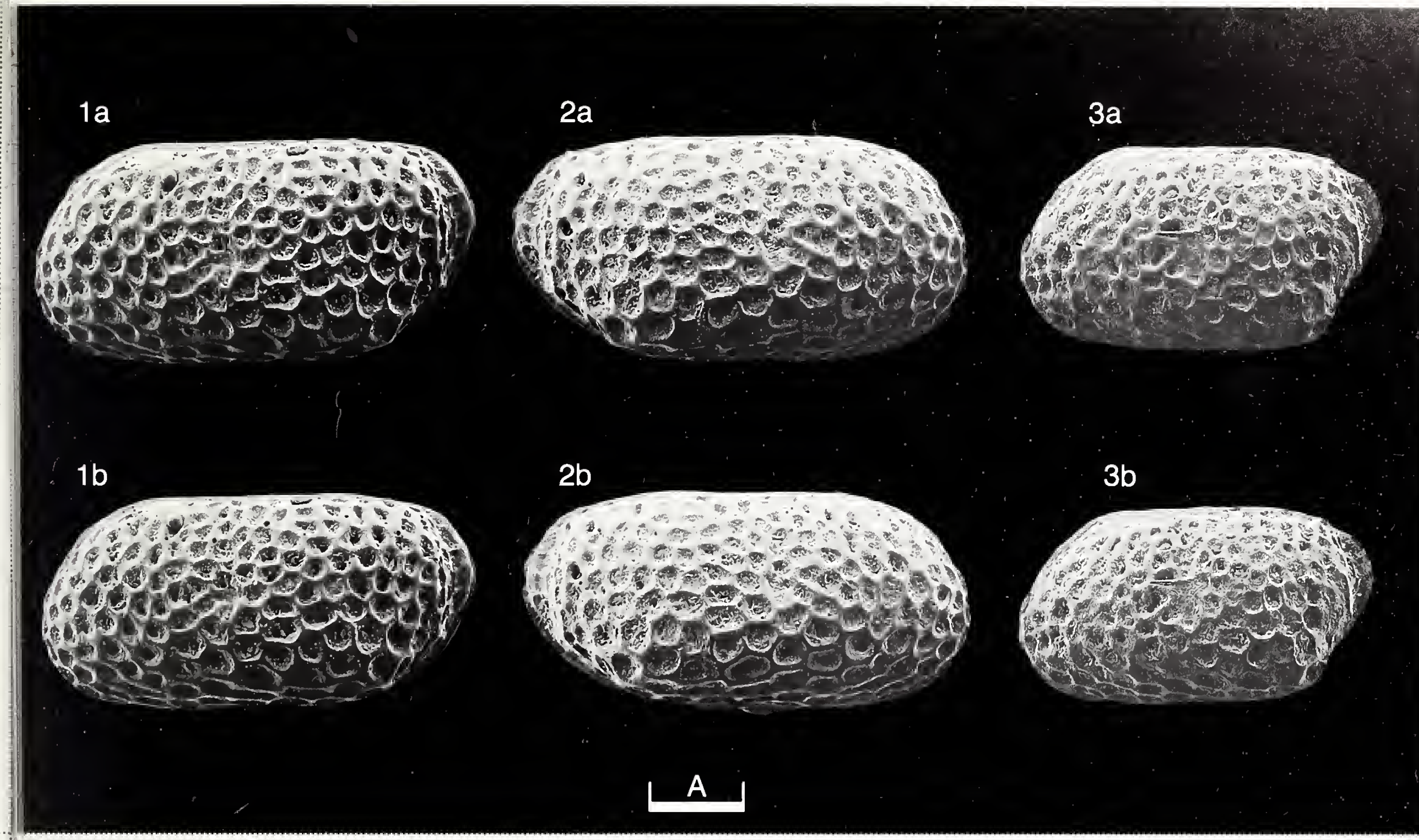
Diagnosis: A small to medium-sized, subelliptical *Kuiperiana* with an ornament of polygonal reticulae. Anterior margin rounded and downturned; posterior margin rounded and upturned; dorsal margin straight, sometimes slightly obscured by valve's tumidity; ventral margin curved, but obscured posteriorly by a subrounded alar protuberance. Eye spot smooth and connected with reticulae. RV hinge composed anteriorly of a comma-shaped socket arching around a subovoid tooth and continuous with the median element, which is a smooth groove. The posterior terminal element is a narrow bar with a frill-like dorsal edge. In the LV the anterior terminal element is a comma-shaped tooth enclosing a small subovoid socket. The median element is a smooth bar communicating with the anterior terminal tooth. The posterior terminal element is a comma-shaped socket and subovoid tooth. Muscle scars an oblique row of 4 adductors with a 'c'-shaped frontal open dorsally. Fulcral point between the median adductors and frontal scar. The 2 mandibular scars are small and circular in outline.

Remarks: This species is similar in size to *Kuiperiana variesculpta* (Ruggieri) (*op. cit.*) and its ornament also appears similar. As Ruggieri's original illustrations are hand drawings and as I have been unable to contact Professor Ruggieri I cannot regard the two species as conspecific. *K. variesculpta* seems, from the illustrations, to have a prominent, strongly laterally compressed anterior margin rim with striate markings parallel to the margin. These features are lacking in *K. paravariesculpta*. The species Whatley & Maybury referred to as *K. variesculpta* (Ruggieri, 1962) (*in:* J. Fourniguet *et al.*, *op. cit.*) is herewith assigned to *K. paravariesculpta*.

Distribution: Upper Pliocene deposits of St. Erth, Cornwall, England (sample nos. 1–4, 7, 10, 12, 14, 16, 18, 21, 23, 25–29) and Upper Pliocene (Redonian) deposits of Apigné Borehole II, Beugnon (sample no. 1), Cricqueville-en-Bessin (sample nos. 5, 9, 13), Falleron, L'Aubier, Le Bosq d'Aubigny, Le Temple du Cerisier, Palluau I (200–280, 380, 640 cm), Palluau II (480, 500–540, 580, >640 cm), Reneauleau, Reneauleau base, Saint-Jean-la-Poterie (sample no. 1549.14) and a mixed sample. See Maybury (*op. cit.*) for further details of the British samples and for the French, see Margerel (*op. cit.*), except for a description of the deposits at Cricqueville-en-Bessin, which may be found in C. Pareyn, P. Brébion, É. Buge, R.-P. Carriol, A. Lauriat-Rage, Y. Le Calvez & J. Roman, *Bull. Mus. natn. Hist. nat. Paris*, ser. 4, **5** (C, 4), 372–373, 1983.

Explanation of Plate 22, 40

Fig. 1, ♂ car., ext. dors. (paratype, **OS 14651**, 490 μm long). Fig. 2, ♂ LV, int. lat. (paratype, **OS 14649**, 490 μm long). Figs. 3, 4, ♂ RV (paratype, **OS 14650**, 550 μm long).
Scale A (100 μm; ×123), figs. 1, 2; scale B (40 μm; ×307), figs. 3, 4.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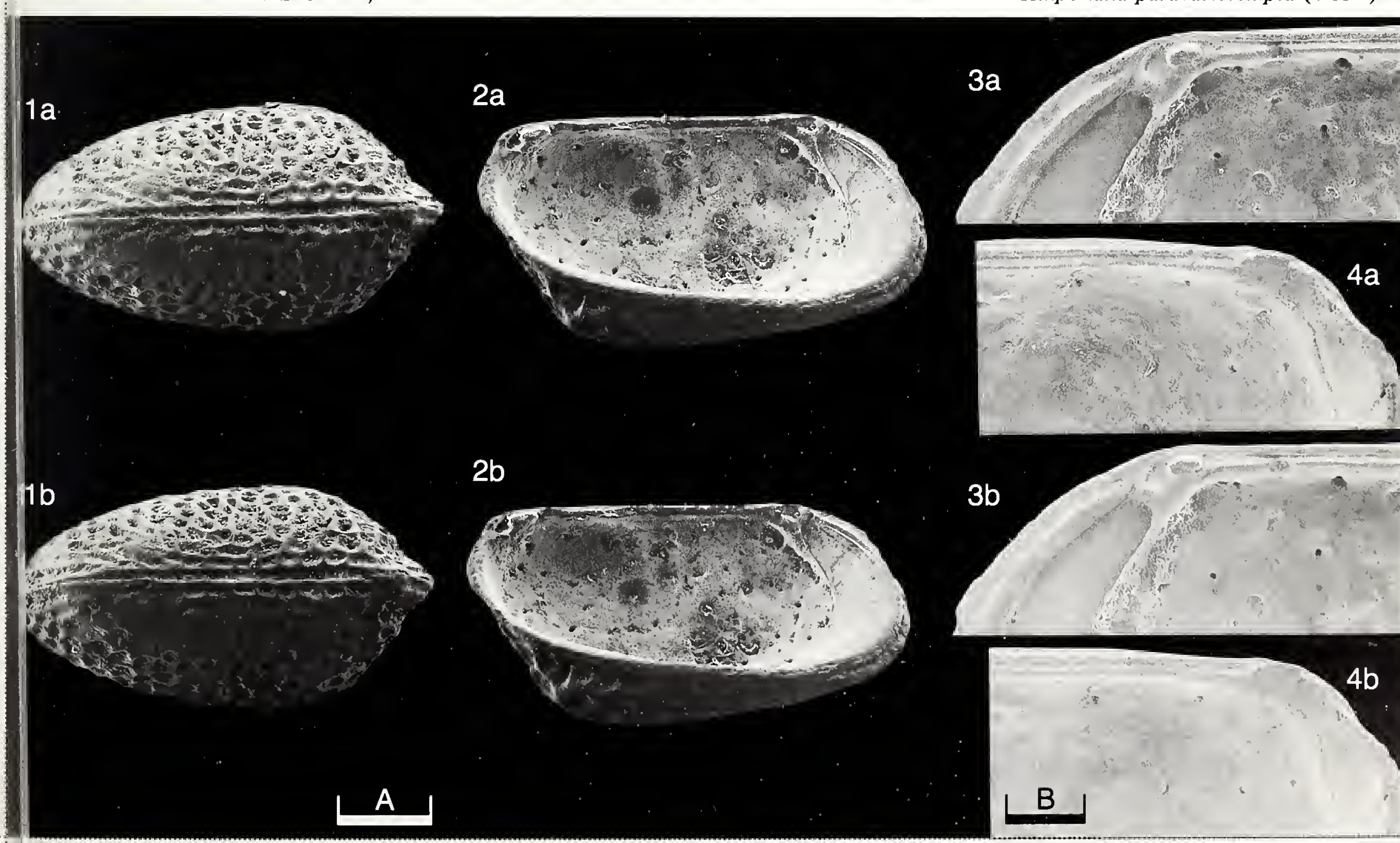
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595.337.14 (119.9) (268 : 162.014.85): 551.353

ON *CYTHEROPTERON BRONWYNAE* JOY & CLARK

by Richard Jones & Robin C. Whatley
(Institute of Earth Studies, University of Wales, Aberystwyth, U.K.)

Cytheropteron bronwynae Joy & Clark, 1977

1977 *Cytheropteron bronwynae* sp. nov., J. A. Joy & D. L. Clark, *Micropaleontology*, **23**, 140, Pl. 2, figs. 1–3.

Type specimens: Department of Geology and Geophysics, University of Wisconsin, Madison (UW): Holotype (**UW 1597-5a**); paratypes (**UW 1597-5b–1597-5d**).

Type locality: Core FL 198, 16–1, central Arctic Ocean (lat. 80° 22.19′ N, long. 172° 33.92′ W), water depth 3198 m; Recent.

Figured specimens: The Natural History Museum, London [BMNH] nos. **1995.1281** (♀ RV: Pl. **22**, 42, fig. 1), **1995.1282** (♀ LV: Pl. **22**, 42, fig. 2), **1995.1283** (♂ RV: Pl. **22**, 42, fig. 3), **1995.1284** (♂ LV: Pl. **22**, 42, fig. 4), **1995.1285** (♀ RV: Pl. **22**, 44, figs. 1, 5, 6), **1995.1286** (♀ LV: Pl. **22**, 44, fig. 2), **1995.1287** (juv. LV: Pl. **22**, 44, fig. 3), **1995.1288** (♀ car.: Pl. **22**, 44, fig. 4).

All specimens are from the Morris Jesup Rise, Arctic Ocean (lat. 85° 19.4′ N, long. 14° W) on the ARK VIII/3 (ARCTIC '91) cruise.

Diagnosis: Subovate with pronounced, smooth caudal process; apex just above mid-height. Anterior margin narrowly rounded and bearing 5–6 strong marginal denticles, mainly above apex. Dorsal margin strongly arched in RV with pronounced keel-like rib; less arched in LV. Ventral margins strongly convex, with marked postero-ventral keel, especially in LV. Valve surface coarsely punctate with puncta orientated in

Explanation of Plate 22, 42

Fig. 1, ♀ RV, ext. lat. (**1995.1281**, 700 μm long). Fig. 2, ♀ LV, ext. lat. (**1995.1282**, 700 μm long). Fig. 3, ♂ RV, ext. lat. (**1995.1283**, 700 μm long). Fig. 4, ♂ LV, ext. lat. (**1995.1284**, 700 μm long).
Scale A (200 μm; ×120), figs. 1–4.

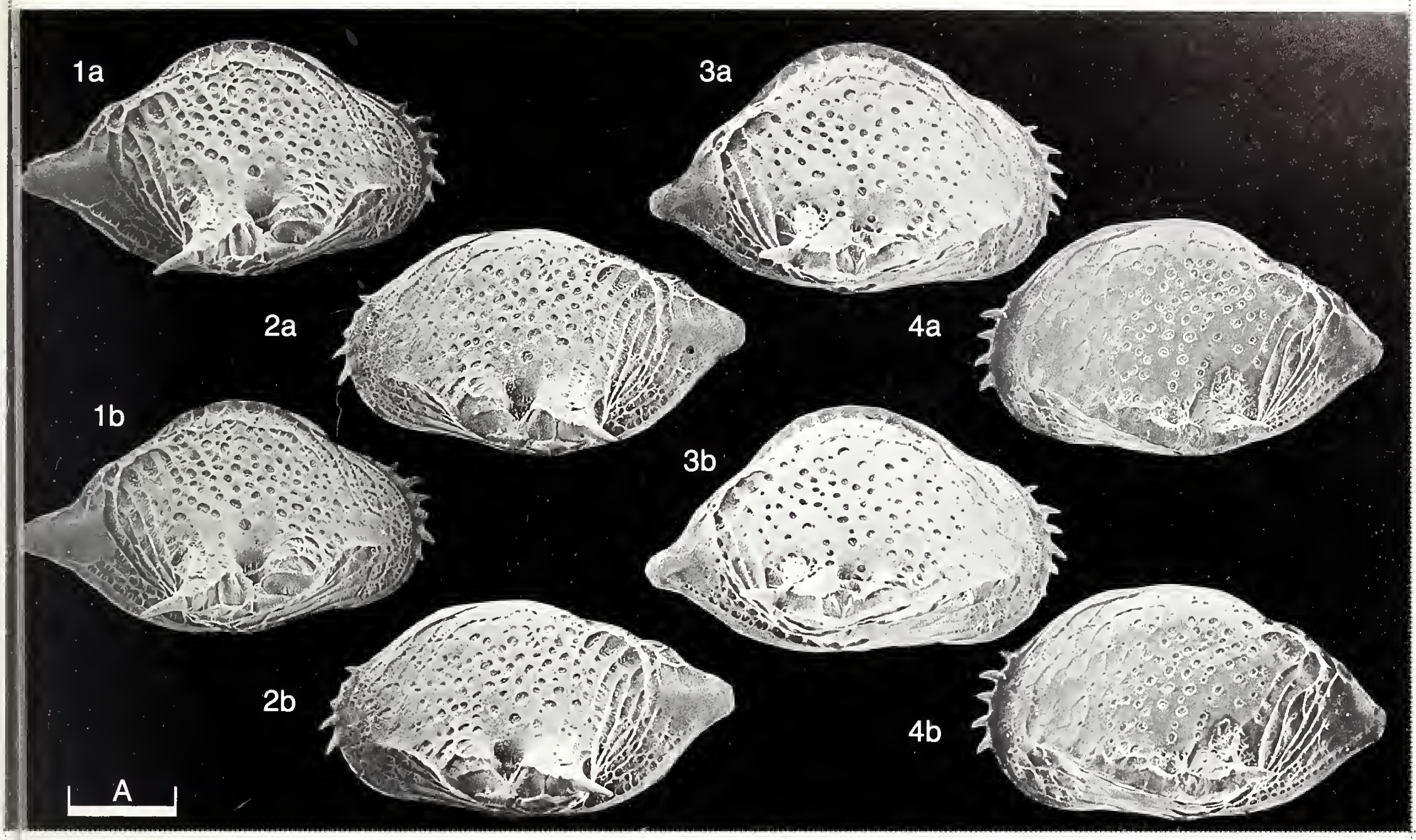
oblique rows and with oblique ribs originating in a postero-dorsal loop crossing valve behind alae. Anterior third with subdued ornament. Ventral surface with parallel ribs and rows of puncta along margin of postero-ventral keel. Alae pronounced; leading edge thick with ventro-lateral deep pit and strong, backward-directed apical spine. Hinge antimerodont with a RV overlap except for the anterior quarter of the hinge where the LV overlaps the RV.

Remarks: This deep water species of *Cytheropteron* co-exists with a number of morphologically similar forms of the same genus in the Arctic Ocean, such as *C. carolinae* Whatley & Coles, 1987 (*Revta esp. Micropaleont.*, **19**, 60), first described from DSDP Leg 94, and *C. hamatum* Sars, 1869 (*Forh. VidenskSelsk. Krist.*, **1868**, 172), first described from the Lofoten Islands and now recognised across the NE Atlantic. The latter differs from the present species primarily by its more acutely tapering alae which possess a characteristic second smaller spine on the training edge. *C. carolinae*, while similar in size and shape to females of *C. bronwynae*, lacks marginal denticles on the anterior margin and has finer puncta on the dorsal alar surface. *C. alatum* Sars, 1866 (*Forh. VidenskSelsk. Krist.*, **1865**, 81) has been compared to *C. bronwynae* but is easily distinguished by its lack of ornamentation and considerably larger alar expansion. Sexual dimorphism is exhibited in many Quaternary and Recent forms of *Cytheropteron*. It is expressed morphologically in *C. bronwynae* in terms of the dimensions of the carapace and length of extension of the alar spines. The shorter, higher forms are probably males and possess a shorter spine.

Distribution: *C. bronwynae* is the only known endemic deep water Arctic species. It is common at depths below 1000 m and together with *Krithe* dominates ostracod assemblages in deep basins which are influenced by the lower Arctic Ocean deep watermass between 2500 and 4500 m. *C. bronwynae* differs from other high latitude species by being absent from the Greenland Sea and by its widespread occurrence in the Canadian and Eurasian basins either side of the Lomonosov Ridge, a well known migrational barrier. A number of *Krithe* and *Cytheropteron* species are absent or rare on the Canadian side of the ridge. The species characterises glacial-age (cold) sediments.

Explanation of Plate 22, 44

Fig. 1, 5, 6, ♀ RV (**1995.1285**, 685 μm long): fig. 1, ext. lat.; figs. 5, 6, ant. and post. hinge elements. Fig. 2, ♀ LV, int. lat. (**1995.1286**, 685 μm long). Fig. 3, juv. LV, ext. lat. (**1995.1287**, 600 μm long). Fig. 4, ♀ car. dors. (**1995.1288**, 700 μm long).
Scale A (200 μm; ×120), figs. 1–4; scale B (100 μm; ×350), figs. 5, 6.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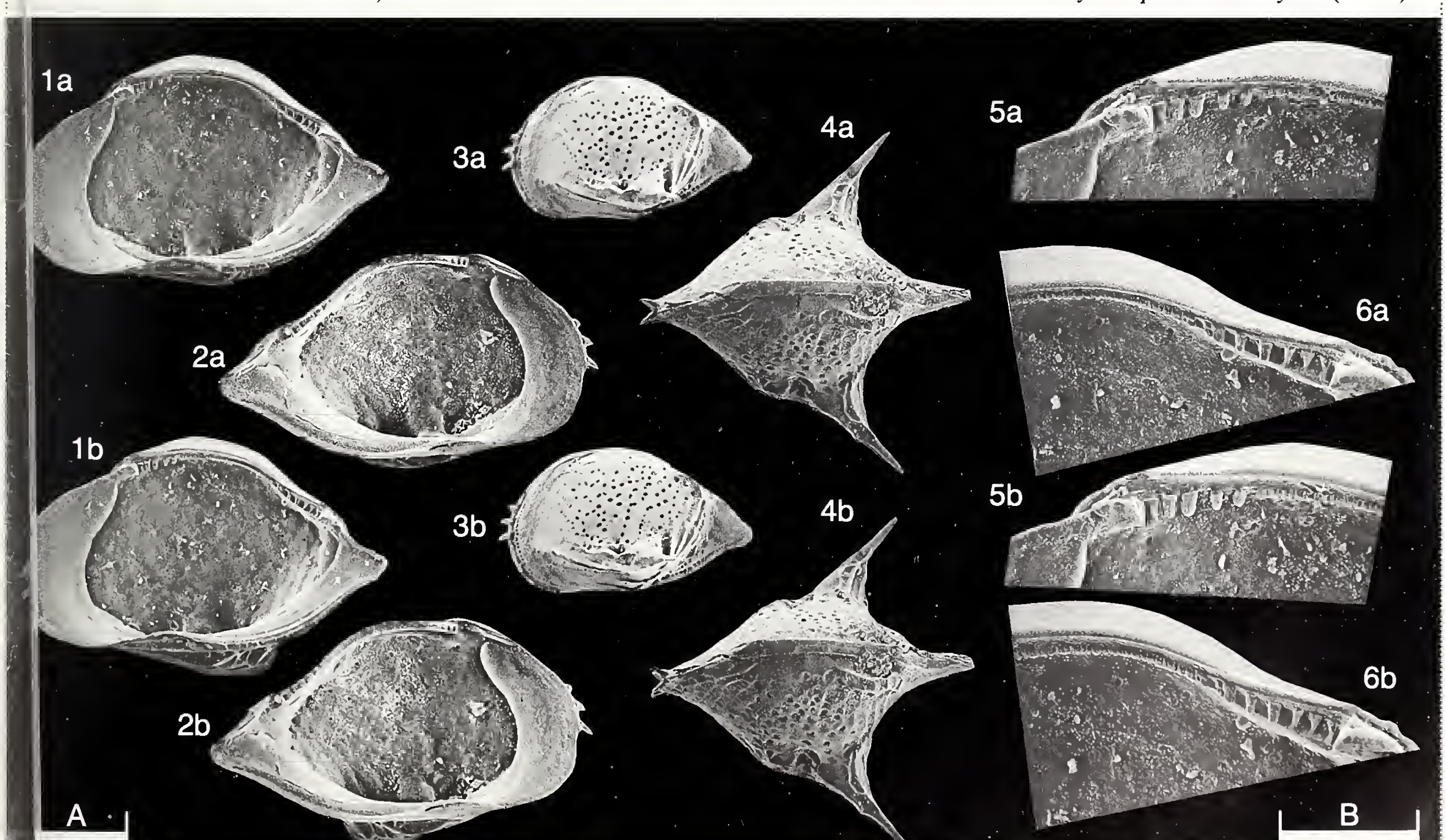
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595.337.3 (116.331 + 116.332 + 116.333.1) (420 : 161.000.51 + 161.001.51): 551.35

ON *CYTHERELLOIDEA KAYEI* WEAVER

by David J. Horne[1], Amnon Rosenfeld[2] & Ian Slipper[1]
*([1]School of Earth Sciences, University of Greenwich, Chatham, U.K.;
[2]Geological Survey of Israel, Jerusalem)*

Cytherelloidea kayei Weaver, 1982

1982 *Cytherelloidea kayei* sp. nov., P. P. E. Weaver, *Palaeontogr. Soc. (Monogr.)*, **135** (562), 22–23, pl. 3, figs. 4–9.
1988 *Cytherelloidea kayei* Weaver; I. Jarvis, G. A. Carson, M. K. E. Cooper, M. B. Hart, P. N. Leary, B. A. Tocher, D. J. Horne & A. Rosenfeld, *Cret. Res.*, **9**, 34, fig. 15 (h).
1988 *Cytherelloidea kayei* Weaver; I. P. Wilkinson, *in:* T. Hanai, N. Ikeya & K. Ishizaki (Eds.), *Evolutionary Biology of Ostracoda*, Kodansha, Tokyo, pl. 1, fig. 9.
1990 *Cytherelloidea kayei* Weaver; D. J. Horne, I. Jarvis & A. Rosenfeld, *in:* R. Whatley & C. Maybury (Eds.), *Ostracoda and Global Events*, Chapman & Hall, London, 127, pl. 2, fig. 1.

Holotype: The Natural History Museum, London [BMNH] no. **OS 9464**; ♀ RV. [Paratypes: BMNH nos. **OS 9465–OS 9479**].

Type locality: Bluebell Hill, Kent, SE England (lat. 51° 20′ N, long. 00° 30′ E), Lower Chalk Formation, Zig Zag Chalk Member, 3.5 m below the Plenus Marls, Upper Cenomanian.

Explanation of Plate 22, 46

Figs. 1, 5, ♀ RV (holotype, **OS 9464**, 595 μm long): fig. 1, ext. lat.; fig. 5, ext. vent. obl. Figs. 2, 4, 6, ♂ car. (paratype, **OS 9465**, 570 μm long): fig. 2, lt. lat.; fig. 4, dors.; fig. 6, lt. vent. obl. Fig. 3, ♀ car. dors. (paratype, **OS 9466**, 600 μm long).
Scale A (100 μm; ×90), figs. 1–6.

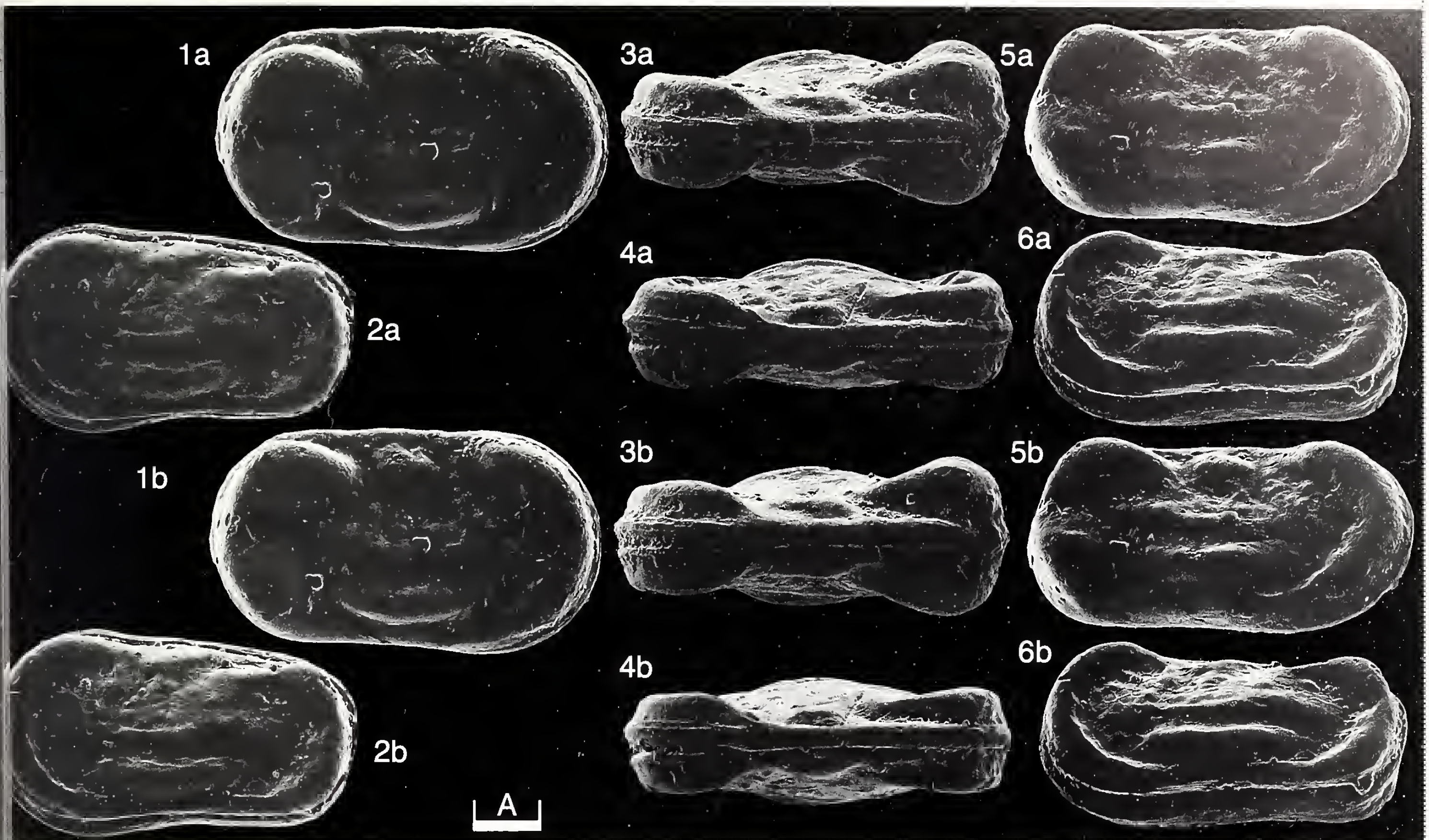
Figured specimens: The Natural History Museum, London [BMNH] nos. **OS 9464** (holotype, ♀ RV: Pl. **22**, 46, fig. 1, 5), **OS 9465** (paratype, ♂ car.: Pl. **22**, 46, figs. 2, 4, 6), **OS 9466** (paratype, ♀ car.: Pl. **22**, 46, fig. 3), **OS 14680** (♀ RV: Pl. **22**, 48, fig. 1, 2), **OS 14681** (♀ LV: Pl. **22**, 48, figs. 3, 4; Pl. **22**, 52, fig. 5), **OS 14682** (♂ LV: Pl. **22**, 48, figs. 5, 6), **OS 13134** (♀ RV: Pl. **22**, 50, figs. 1, 2), **OS 13133** (♂ RV: Pl. **22**, 50, figs. 3, 4), **OS 14683** (♀ RV: Pl. **22**, 50, fig. 5), **OS 13294** (♀ RV: Pl. **22**, 52, figs. 1, 2), **OS 14684** (♀ RV: Pl. **22**, 52, fig. 3, 4).

The holotype and paratypes were collected from the type locality and horizon by P. P. E. Weaver. **OS 14680–OS 14682** are from the Upper Cenomanian Zig Zag Chalk Member (Lower Chalk Formation) at Abbots Cliff, near Folkestone, Kent, SE England (lat. 51° 06′ N, long. 01° 14′ E), 4.6 m below the base of the Plenus Marls (sample ABC-1), collected by D. J. Horne. **OS 14683**, **OS 14684** are from the Coniacian Seaford Member (Upper Chalk Formation) at Langdon Stairs, near Dover, Kent (lat. 51° 08′ N, long. 01° 19′ E), from samples D19 and D23 respectively (collected by D. J. Horne and A. Rosenfeld). **OS 13294** is from the Turonian New Pit Member (Middle Chalk Formation) at Akers Steps, near Dover (lat. 51°08′ N, long. 01° 17′ E), from sample AKS-C, collected by D. J. Horne and A. Rosenfeld.

Diagnosis: A species of *Cytherelloidea* with prominent, thick anterior marginal rib, an arcuate ventrolateral rib, and posterodorsal and posteroventral swellings in both sexes. The anterior marginal rib runs from below the anterior end of the relatively straight dorsal margin to about halfway along the weakly sinuous ventral margin, the ventral segment being less swollen and tapering posteriorly. The ventrolateral rib is swollen centrally and connects posteriorly, via a constricted section, to the

Explanation of Plate 22, 48

Figs. 1, 2, ♀ RV (**OS 14680**, 585 μm long): fig. 1, ext. lat.; fig. 2, ext. vent. obl. Figs. 3, 4, ♀ LV (**OS 14681**, 550 μm long): fig. 3, ext. lat.; fig. 4, ext. vent. obl. Figs. 5, 6, ♂ LV (**OS 14682**, 490 μm long): fig. 5, ext. lat.; fig. 6, ext. vent. lat.
Scale A (100 μm; ×90), figs. 1–6.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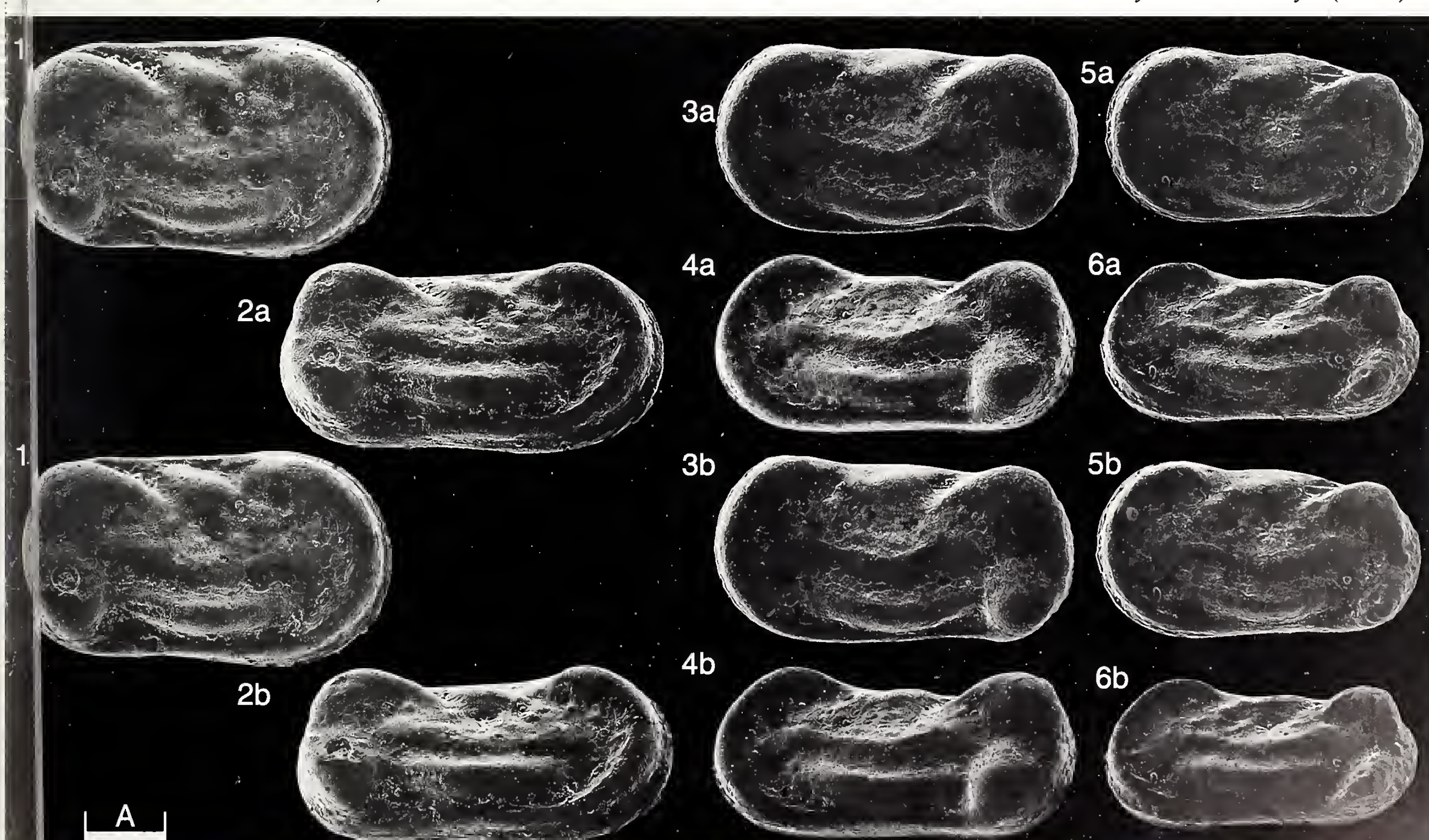
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posteroventral swelling. The posterodorsal swelling is produced anteriorly into a short, tapering diagonal rib which fades out in the direction of the central muscle scar pit. A short, swollen rib inclined down towards the anterior is situated between the top of the central muscle pit and the dorsal margin. A weak arcuate rib slightly swollen at each end, runs longitudinally between the central muscle pit and the more prominent ventrolateral rib. Sexual dimorphism clear; males more tapered posteriorly in lateral outline and with less prominent posterior swellings which in some specimens tend to form a continuous posterior marginal rib. Well-preserved specimens show a fine polygonal reticulation covering most of the external surfaces.

Remarks: Comparison of specimens of *Cytherelloidea kayei* from different parts of its stratigraphic range show subtle differences in the development of the ribs. In particular, the subcentral rib running longitudinally immediately below the muscle pit tends to be narrow and evenly developed in Cenomanian specimens (e.g. Pl. **22**, 50, figs. 1, 2) but stratigraphically higher specimens show the development of weak nodes or swellings at each end of this rib (e.g. Pl. **22**, 52, figs. 1, 2 (Turonian) and Pl. **22**, 52, figs. 3, 4 (Coniacian)). In this respect some of the younger specimens resemble *Cytherelloidea binoda* Clarke (*Geol. Jb.*, **A61**, 45–46, pl. 1, figs. 1–5, 1982) from the Coniacian of NW Germany, which we consider to be a distinct but closely related species. *C. binoda* differs from *C. kayei* in that the rib connecting the two subcentral swellings is absent or at best very weakly developed, and the dorsolateral and posterodorsal diagonal ribs are fused, giving the appearance of a single, sinuous rib, tapering towards the anterior. Since these features are more easily distinguished in oblique ventrolateral views, we have followed Clarke's (*op. cit.*) practice in providing such illustrations is addition to the standard lateral views. *C. binoda* is also larger (length of adults 660–770 μm) than *C. kayei* (< 650 μm long).

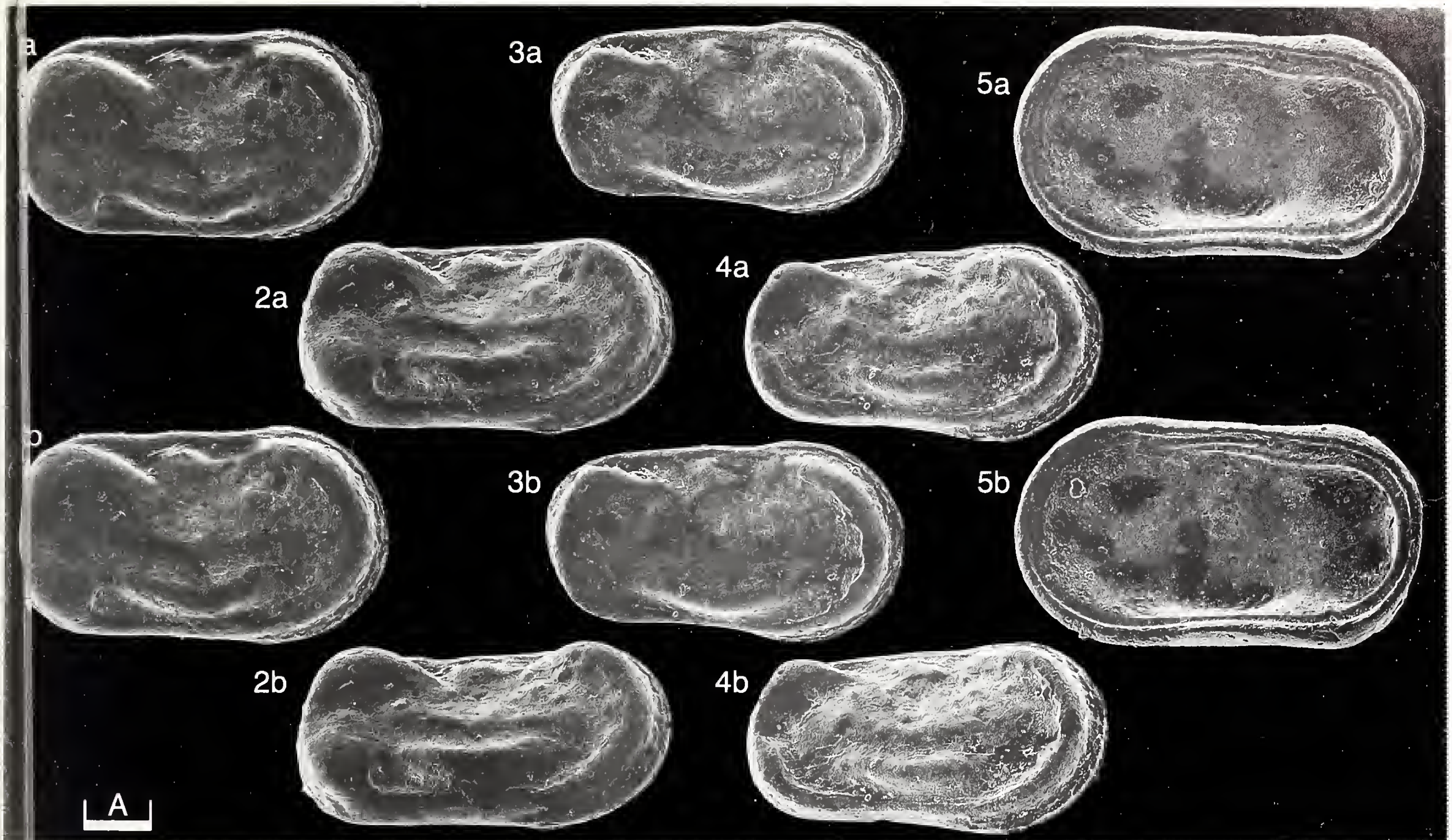
Explanation of Plate 22, 50

Figs. 1, 2, ♀ RV (**OS 13134**, 570 μm long): fig. 1, ext. lat.; fig. 2, ext. vent. obl. Figs. 3, 4, ♂ RV (**OS 13133**, 540 μm long): fig. 3, ext. lat.; fig. 4, ext. vent. obl. Fig. 5, ♀ RV, int. lat. (**OS 14683**, 620 μm long).
Scale A (100 μm; ×90), figs. 1–5.

Distribution: Marine Upper Cretaceous of the Anglo-Paris Basin: Cenomanian – Coniacian stages. In England, the occurrence of *C. kayei* in the lowest Cenomanian is confirmed (Wilkinson, *op. cit.*); it has also been reported (but not illustrated) in the Upper Albian Hunstanton Chalk Member by Wilkinson, 1990 (*Cour. ForschInst. Senckenberg*, **123**, 239–258).

Explanation of Plate 22, 52

Figs. 1, 2, ♀ RV (**OS 13294**, 600 μm long): fig. 1, ext. lat.; fig. 2, ext. vent. obl. Figs. 3, 4 (**OS 14684**, 625 μm long): fig. 3, ext. lat.; fig. 4, ext. vent. obl. Fig. 5, ♀ LV, int. lat. (**OS 14681**, 550 μm long).
Scale A (100 μm; ×90), figs. 1–5.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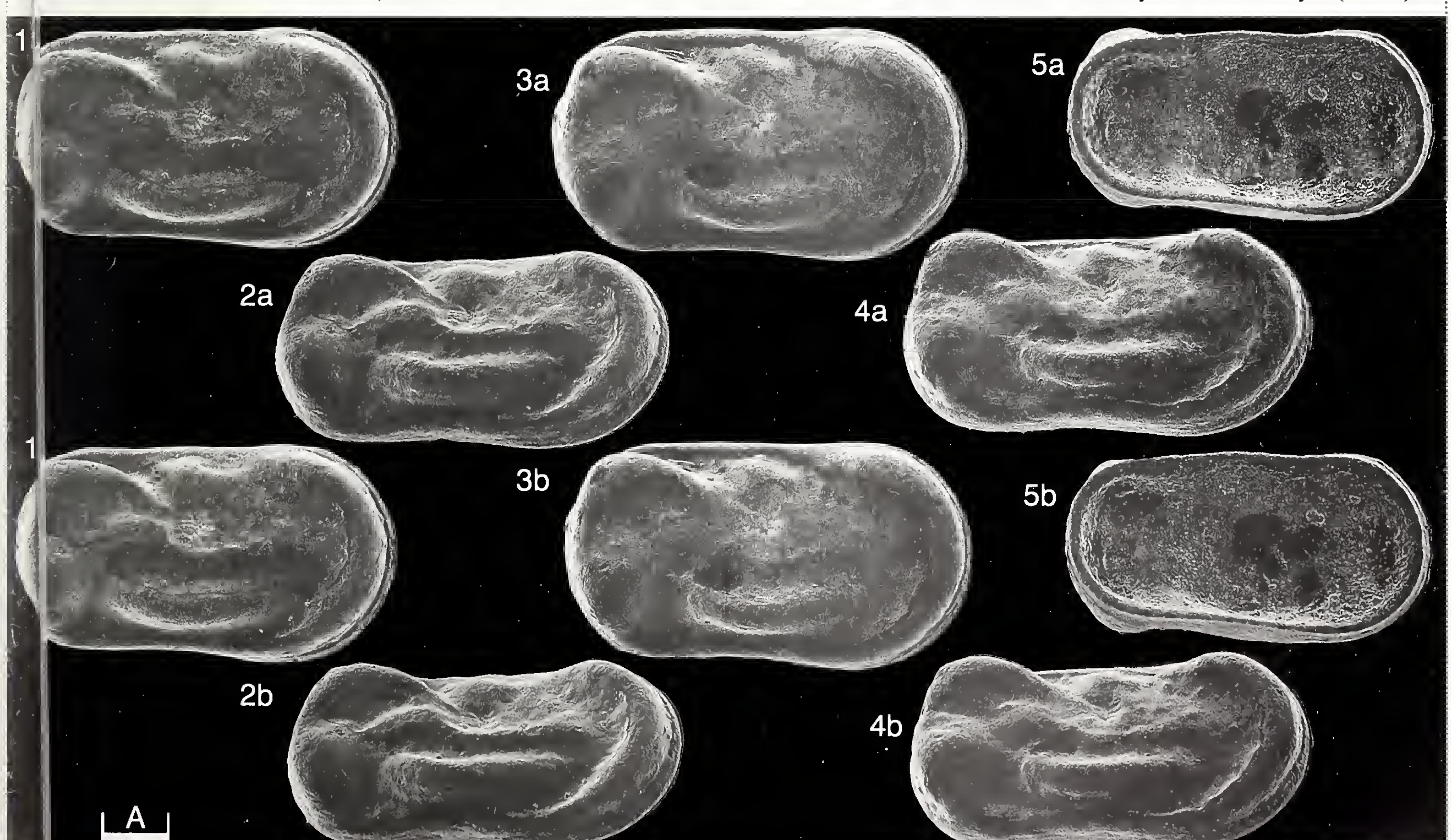
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595.337.14 (119.1 + 119.4 + 119.9) (485 : 161.011.58 + 489 : 161.010.57 + 714 : 162.070.47 + 798 : 162.151.70): 551.351.

ON *SEMICYTHERURA COMPLANATA* (BRADY, CROSSKEY & ROBERTSON)

by David J. Horne & Alan R. Lord
(School of Earth Sciences, University of Greenwich, Chatham & Department of Geological Sciences, University College London, England)

Semicytherura complanata (Brady, Crosskey & Robertson, 1874)

1874 *Cytherura (?) complanata* sp. nov., G. S. Brady, H. S. Crosskey & D. Robertson, *Palaeontogr. Soc. (Monogr.)*, **1874**, 194, pl. 11, figs. 19, 20.
1982 *'Cytherura' complanata* Brady, Crosskey & Robertson; A. R. Lord, *Sver. geol. Unders. Afh.*, **C794**, 138, 145.
1987 *Semicytherura complanata* (Brady, Crosskey & Robertson); T. M. Cronin *in:* N. R. Gadd (Ed.), *Late Quaternary development of the Champlain Sea Basin*, Geol. Assoc. Canada, Special Publ., 20–21, pl. 3, figs. 7–9.
1987 *Semicytherura* sp., K. L. Knudsen & D. N. Penney, *Danm. geol. Unders.*, **B10**, 54, pl. 2, figs. 5, 6.
1987 *Semicytherura complanata* (Brady, Crosskey & Robertson); T. M. Cronin & N. Ikeya, *J. Micropalaeontol.*, **6** (2), 85, pl. 3, fig. 17.

Holotype: Not defined. No material in the Brady Collection, Hancock Museum, Newcastle-upon-Tyne; the Crosskey Collection, Hunterian Museum, Glasgow has two poorly preserved RV, one broken (slide **610**).

Type locality: Annochie, E Scotland (Nat. Grid. Ref. NK 104 532; lat. 57° 34′ 20″ N, long. 1° 49′ 40″ W). Original material from this locality.

Figured specimens: Senckenberg Museum, Frankfurt, Germany nos. **Xe 18047** (♂ LV: Pl. **22**, 54, fig. 3), Skagen Borehole, North Jutland, Denmark (lat. 57° 46′ N, long. 10° 40′ E), 115.14 m; **18048** (♂ car.: Pl. **22**, 56, fig. 1; Pl. **22**, 58, fig. 2), **18049** (♀ RV: Pl. **22**, 58, fig. 4) and **18050** (♂ LV: Pl. **22**, 54, fig. 1), Skagen Borehole,

Explanation of Plate 22, 54

Fig. 1, ♂ LV, ext. lat. (**Xe 18050**, 400 μm long). Fig. 2, ♀ LV, ext. lat. (**18051**, 400 μm long). Fig. 3. ♂ LV, int. lat. (**18047**, 400 μm long). Scale A (100 μm; ×150), figs. 1–3.

119.19 m; **18051** (♀ LV: Pl. **22**, 54, fig. 2), **18052** (♀ RV: Pl. **22**, 56, fig. 2) and **18053** (♀ car.: Pl. **22**, 58, fig. 3), Skagen Borehole, 121.34 m; **18054** (♀ RV: Pl. **22**, 56, fig. 3; Pl. **22**, 58, fig. 1), Skagen Borehole, 125.49 m; **18055** (♀ RV: Pl. **22**, 58, fig. 5), Skagen Borehole, 127.34 m; all from the Pleistocene (Weichselian). **Xe 18058** (♀ LV: Pl. **22**, 60, figs. 1, 2) and **18059** (♀ RV: Pl. **22**, 60, figs. 3, 4), Moltemyr Borehole, Sweden (lat. 58° 26′ 45″ N, long. 11° 32′ 36″ E), 6.10–6.20 m (see Lord, *op. cit.*, 1982); Pleistocene (Weichselian). The Natural History Museum, London [BMNH], Palaeontology Dept. no. **OS 13355** (♀ RV: Text-fig. 1), Pt. Originaux, Quebec, Canada (lat. 47° 29′ N, long. 70° 01′ W), T. Cronin Colln., *c.* 10,000 BP; Zoology Dept. no. **1988.317** (♀ LV and appendages: Text-figs. 2a–c), BARNES 58–60, Beaufort Sea, Alaska (lat. 70° 36.69′ N, long. 150° 24.7′ N), E. Brouwers Colln.; Recent.

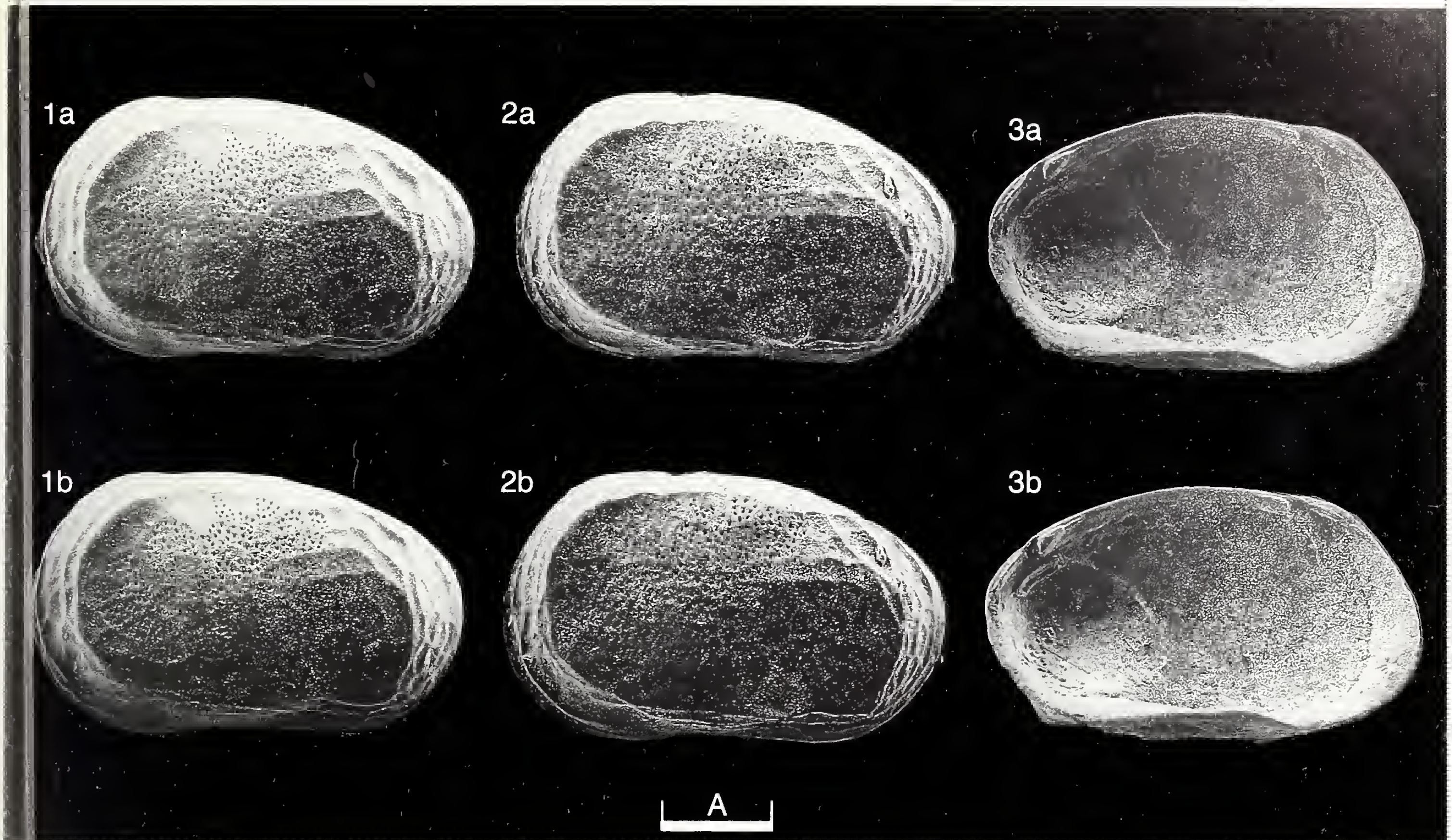
Diagnosis: A species of *Semicytherura* lacking a caudal process and characterised by subquadrate outline, a rim running around all margins, and ornament consisting of a primary reticulation of fine ribs posteriorly passing in the mid-valve area into an even punctation (secondary reticulation) which dominates the anterior half of the valve. Weakly dimorphic.

Remarks: A neotype should probably be defined from the material figured here, as recent investigations in the type area of Annochie did not yield ostracods (A. Hall & J. Jarvis, *Quaternary Newsl.*, **59**, 5–7, 1989) and the only specimens in the Crosskey Collection are poorly preserved. We would, however, prefer a neotype to be defined from Scottish material.

The species is unusual for *Semicytherura* in lacking a caudal process but features of the marginal zone (Text-figs. 1, 2a) and the appendages (Text-figs. 2b, 2c; Recent, Beaufort Sea, Alaska) confirm the generic identification. Some variation in the strength of development of ornament is evident in our material and in published illustrations but the significance is not clear. The ornamental pattern is unusual; posteriorly, a network of fine primary ribs forms cells which enclose 'blind' puncta, but this changes in mid-valve along a distinct line (Pl. **22**, 58, fig. 2) with the primary ribbing fading so that the secondary punctate ornament dominates the anterior part of the valve and the puncta appearing 'open'. Right valves show a small postero-ventral marginal alar protuberance.

Explanation of Plate 22, 56

Fig. 1, ♂ car., ext. lat. (**Xe 18048**, 375 μm long). Fig. 2, ♀ RV, ext. lat. (**18052**, 375 μm long). Fig. 3, ♀ RV, int. lat. (**18054**, 400 μm long).
Scale A (100 μm; ×160), figs. 1, 2; scale B (100 μm; ×150), fig. 3.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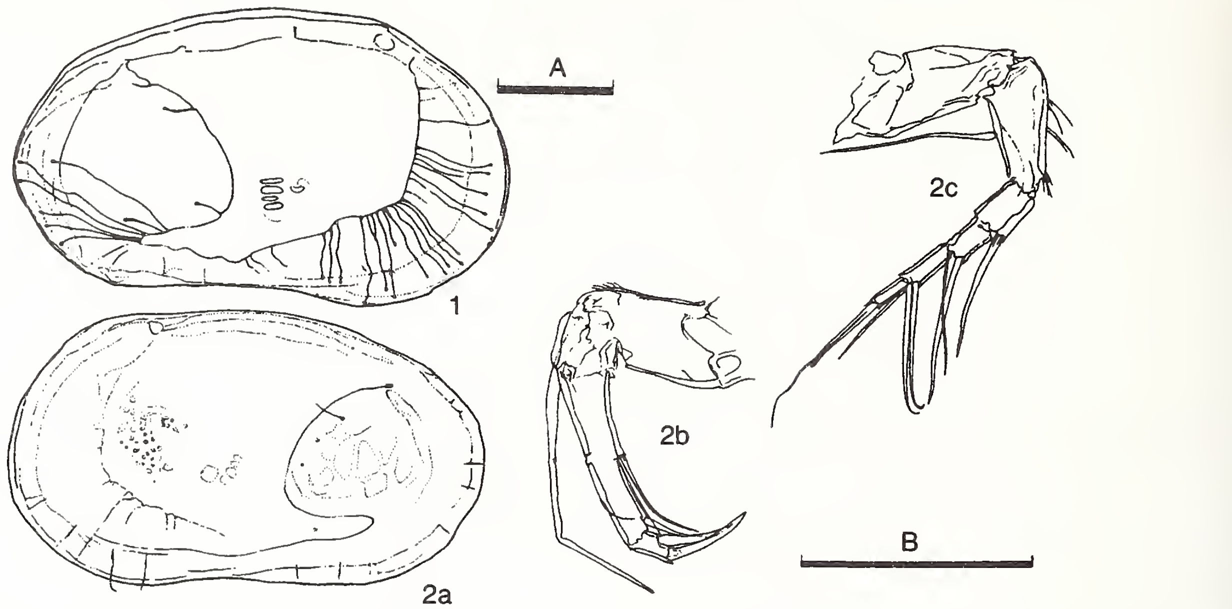
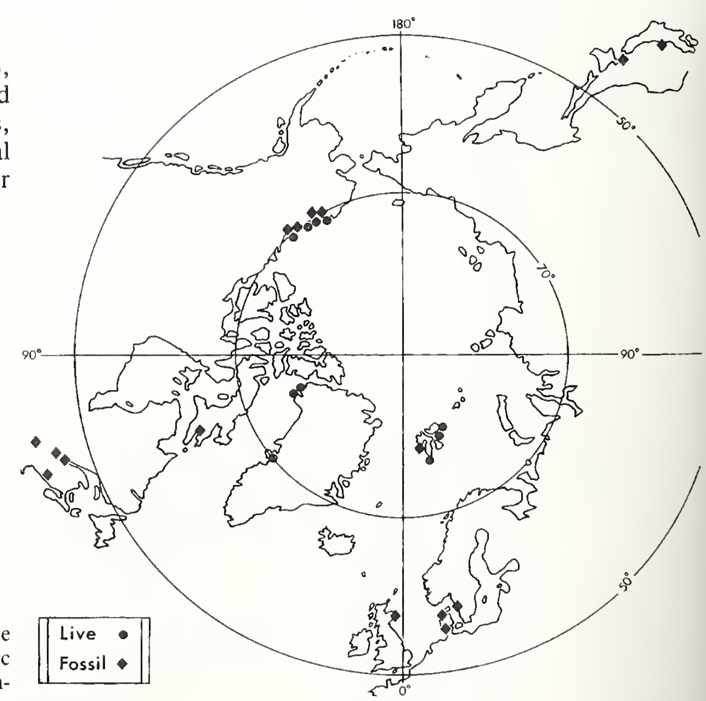


Text-fig. 1. ♀ RV, ext. lat. in transmitted light (**OS 13355**, 400 μm long). Text-fig. 2. ♀ LV (**1988.317**, 400 μm long). 2a, ext. lat. in transmitted light; 2b, antenna; 2c, antennula.
Scale A (100 μm), text-figs. 1, 2a; scale B (100 μm), text-figs. 2b, c.

Explanation of Plate 22, 58

Fig. 1, ♀ RV, ant. hinge (**Xe 18054**). Fig. 2, ♂ car., detail mid-valve (**18048**). Fig. 3, ♀ car., dors. (**18053**, 400 μm long). Fig. 4, ♀ RV, 'open' pores, ant. mid-valve (**18049**, 400 μm long). Fig. 5, ♀ RV, 'closed' pores, post. mid-valve (**18055**, 350 μm long).
Scale A (20 μm; ×700), figs. 1, 2, 5; scale B (100 μm; ×150), fig. 3; scale C (10 μm, ×2100), fig. 4.

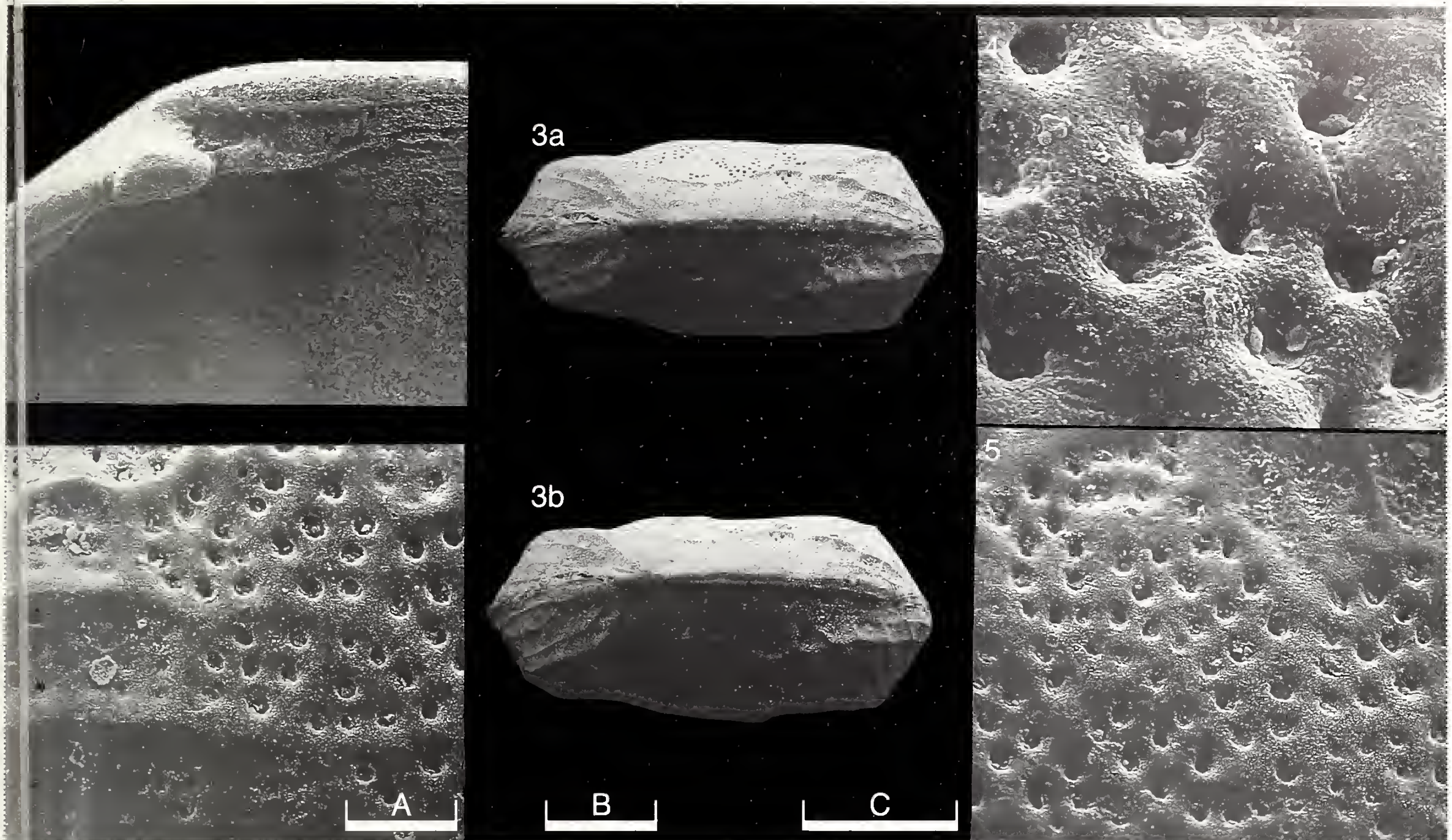
Acknowledgements:
Drs E. M. Brouwers (USGS, Denver) and T. M. Cronin (USGS, Reston) kindly provided material and data from Alaska and eastern North America respectively. K. L. Knudsen (Aarhus, Denmark) generously supplied Danish and Swedish material figured here, Miss T. J. Paramor (UCL) prepared material and Mr J. Davy (UCL) prepared the micrographs.



Text-fig. 3. Distribution of *S. complanata:* Late Pliocene (Alaska), Pleistocene and Holocene. Living in Beaufort Sea, Alaska. Widespread coldwater, Arctic species. Known fossil from NW Europe, eastern N America, Svalbard, Greenland, Alaska and Japan.

Explanation of Plate 22, 60

Fig. 1, ♀ LV, ext. lat. (**Xe 18058**, 400 μm long). Fig. 2, detail mid-dorsal area (**18058**). Fig. 3, ♀ RV, ext. lat. (**18059**, 400 μm long). Fig. 4, detail mid-dorsal area (**18059**).
Scale A (100 μm; ×150), figs. 1, 3; scale B (20 μm; ×700), figs, 2, 4.



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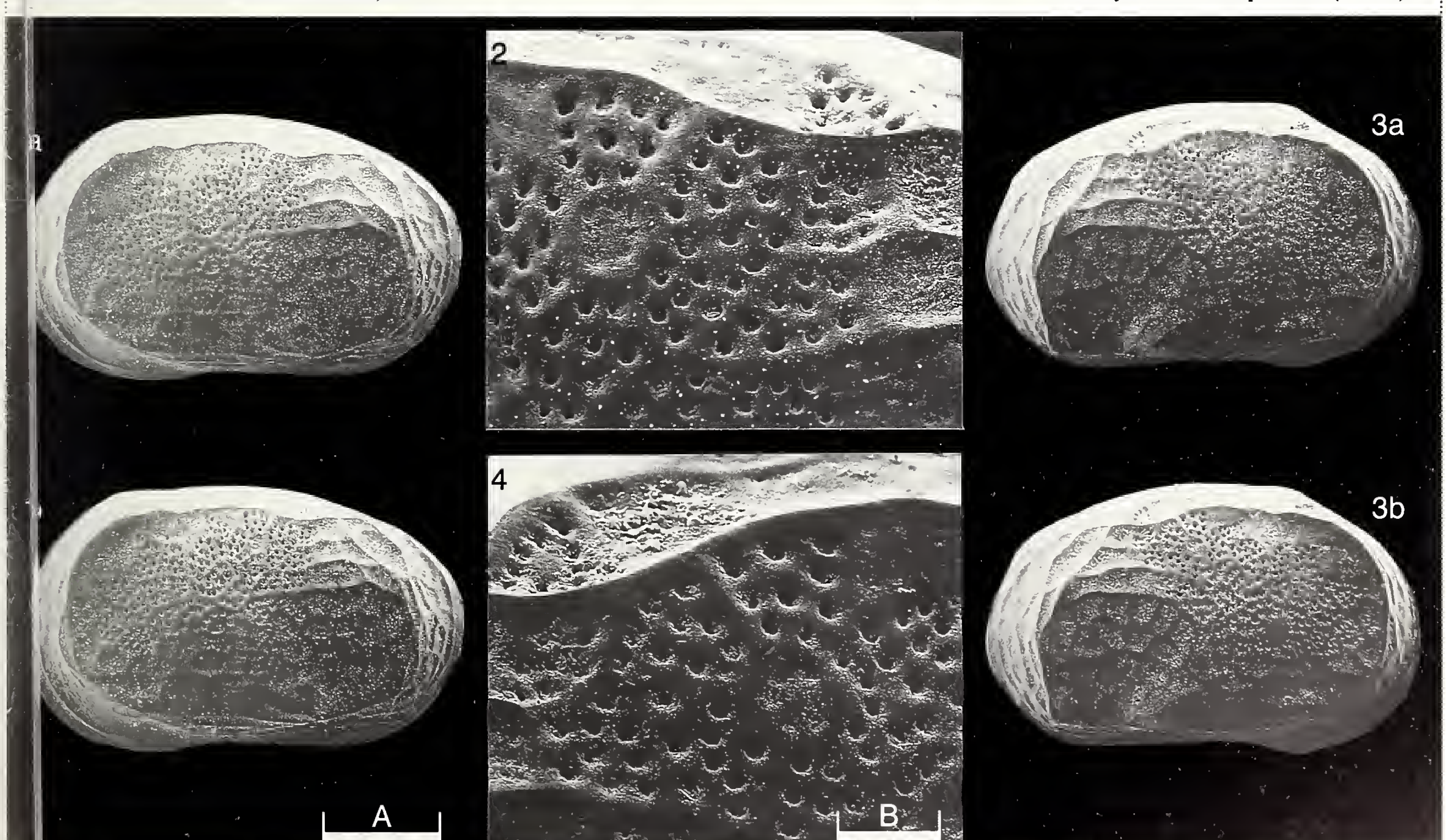

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ON *POLONIELLA SCHALLREUTERI* LUNDIN nom. nov.

by Robert F. Lundin
(Arizona State University, Tempe, U.S.A.)

Poloniella schallreuteri nom. nov.

non 1964 *Poloniella (Parapoloniella) adamczaki* sp. nov., H. Jordan, *Freiberger ForschHft.*, **C170**, 46–47.
non 1983 *Poloniella adamczaki* sp. nov., B. Żbikowska, *Palaeont. pol.*, **44**, 42–43.
1994 *Poloniella adamczaki* sp. nov., R. F. Lundin, *Stereo-Atlas Ostracod Shells*, **21**, 111–114.

Remarks: Drs Helga Uffenorde (University of Göttingen) and Roger Schallreuter (University of Hamburg) have both kindly informed me that I created a primary homonym when I named a new species *Poloniella adamczaki* (Lundin, 1994). That name is occupied by *Poloniella adamczaki* Żbikowska, 1983 which is in turn preoccupied by *Poloniella (Parapoloniella) adamczaki* Jordan, 1964. I hereby replace the 1994 junior primary homonym with the new name *Poloniella schallreuteri* in recognition of the many contributions Dr Schallreuter has made to our knowledge of ostracods.

Stereo-Atlas of Ostracod Shells: Vol. 22, Part 1

CONTENTS

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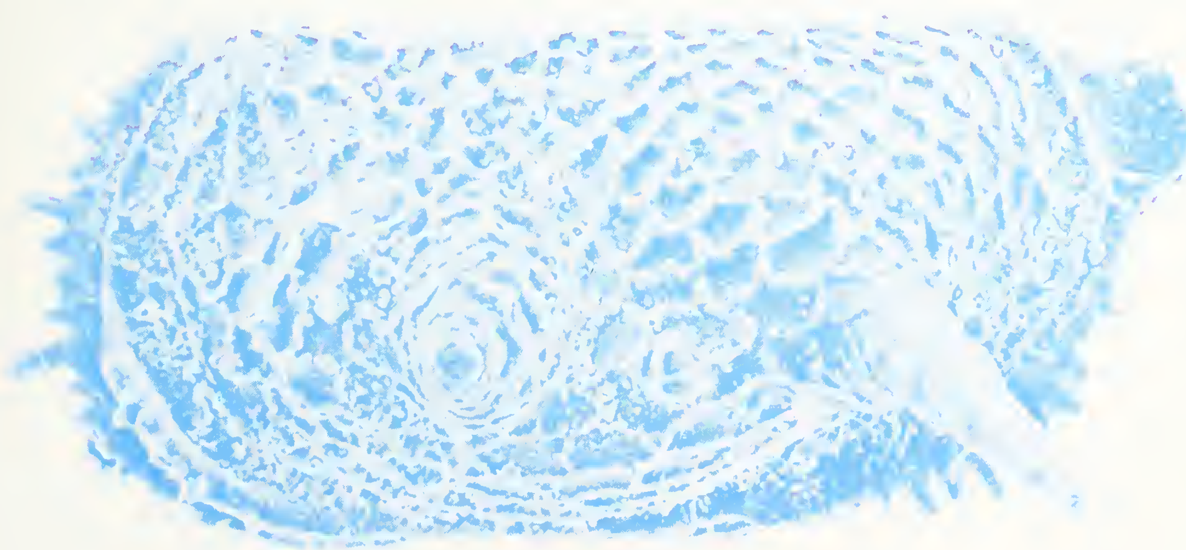
edited by I. Boomer, D. J. Horne, A. R. Lord, D. J. Siveter, and J. E. Whittaker

Volume 22, Part 2; 31st December, 1995



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Instructions to Authors

Contributions illustrated by scanning electron micrographs of Ostracoda in stereo-pairs are invited. All contributions submitted for possible publication in *A Stereo-Atlas of Ostracod Shells* are peer-reviewed by an appropriate international specialist. "Instructions to Authors" and plate blanks for mounting photographs may be obtained from any Editor. Manuscripts should be submitted to Dr Ian Boomer.

The front cover shows (upper) the holotype (RV, dorsal view, BMNH no. **OS 14654**) and (lower) a paratype (LV, external lateral view, BMNH no. **OS 14653**) of *Pariceratina ubiquita* Boomer, 1994 from the Palaeogene of ODP Site 865, Central Pacific Ocean. This species was described in *A Stereo-Atlas of Ostracod Shells*, **21**, 79–86.

Stereo-Atlas of Ostracod Shells 22 (15) 62–65 **(1995)**
595.337.14 (118.22) (520 : 161.140.38) : 551.35 + 552.54

ON *KOTORACYTHERE TATSUNOKUCHIENSIS* ISHIZAKI

by Min Huh, Robin C. Whatley & Kwang-Ho Paik
(Department of Geology, Chonnam National University, Kwangju, Korea; Institute of Earth Studies, University of Wales, Aberystwyth, U.K. & Department of Earth and Environmental Sciences, Korea University, Seoul, Korea)

Kotoracythere tatsunokuchiensis Ishizaki, 1966

1966 *Kotoracythere tatsunokuchiensis* sp. nov., K. Ishizaki, *Sci. Rep. Tohoku Univ.*, 2nd Ser. (Geol.), **37**, 2, pl. 18, figs. 13, 14, text-fig. 1, fig. 8.
1992 *Kotoracythere* sp.; M. Huh & K.H. Paik, *J. paleont. Soc. Korea*, Special Publ. 1, pl. 3, figs. 4, 5.
1994 *Kotoracythere* sp.; M. Huh & K.H. Paik & E.H. Lee, *J. paleont. Soc. Korea*, **10**, 1, pl. 1, figs. 3, 4.

Holotype: Institute of Geology and Paleontology, Tohoku University, Sendai, Japan, no. **IGPS 87014**; RV. [paratype, no. **IGPS 87015**].

Type locality: Down stream of the Tatsunokuchi gorge in the western part of Sendai City, Miyagi Pref., Japan, Tatsunokuchi Formation, Sendai Group; Pliocene.

Figured specimens: Department of Geology, Chonnam National University (**CNU**), nos. **CNU-O-544** (paratype, RV: Pl. **22**, 63, fig. 1; Pl. **22**, 65, fig. 3), **CNU-O-545** (LV: Pl. **22**, 63, fig. 2), **CNU-O-546** (LV: Pl. **22**, 63, fig. 3), **CNU-O-547** (LV: Pl. **22**, 65, fig. 1), **CNU-O-548** (LV: Pl. **22**, 65, fig. 2). **CNU-O-544** from the type locality, **CNU-O-545-548** from sample MC1-3, the lower Yeonil Group (Miocene), Pohang Basin, SE Korea (lat. 35°50′20″N, long. 129°17′25″E) (see M. Huh & K.H. Paik, 1992, *op. cit.*).

Diagnosis: A medium sized species of *Kotoracythere*. Anterior margin broadly rounded, posterior margin truncated or subrounded, dorsal margin slightly arched. Surface ornamented with moderate reticulation. Weakly developed

Explanation of Plate 22, 63

Fig. 1, RV, ext. lat. (paratype, **CNU-O-544**, 570 μm long). Fig. 2, LV, ext. lat. (**CNU-O-545**, 570 μm long). Fig. 3, car., ext. lt. lat. (**CNU-O-546**, 570 μm long).
Scale A (200 μm; ×101), figs. 1, 2; scale B (200 μm; ×99), fig. 3.

longitudinal ribs with anterior- and posterior marginal ribs. A ventro-lateral rib terminates in a posteroventral, acutely pointed sub-alar protuberance. Calcified inner lamellar wide anteriorly and posteroventrally. Vestibulum wide anteroventrally. Pentodont hinge with separated distal teeth at each end of the median hinge bar in the left valve. Fulcral point subrounded. Marginal pore canals few, simple.

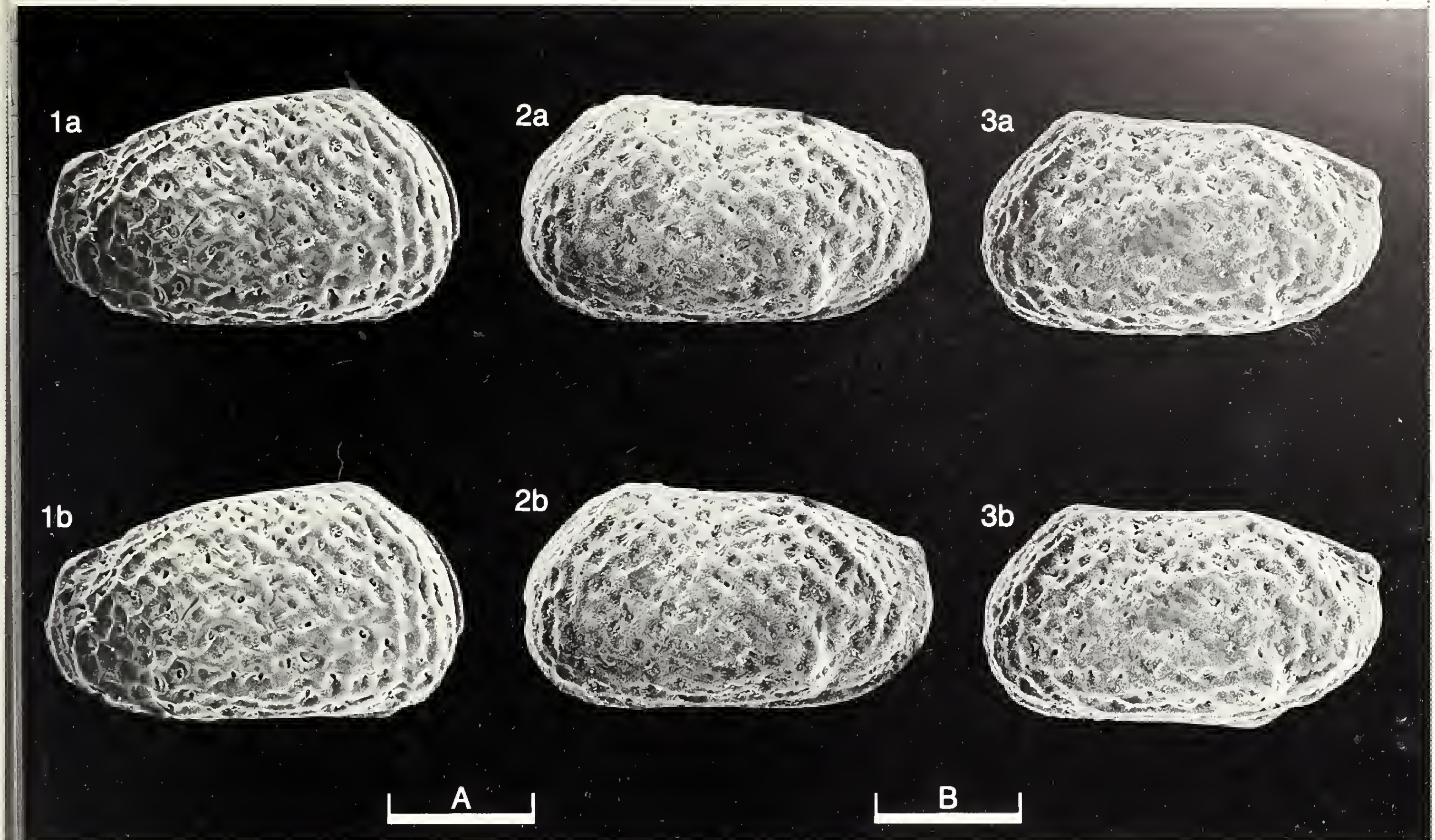
Remarks: Ishizaki (1966, *op. cit.*) described this species from the Pliocene deposits of Japan and suggested that its presence was probably due to the cooler water conditions prevailing during the Pliocene. However, our specimens come from the warmer, Miocene deposits of SE Korea. The Japanese Pliocene material is more compressed posterodorsally and has a less prominent sub-alar process than the present specimens. This species differs from the genotype of *Kotoracythere*, *K. abnorma* Ishizaki (1966, *ibid.*, see T. Hanai *et al.*, Checklist of Ostracoda from Japan and its adjacent Seas, *Bull. Univ. Mus., Tokyo*, **12**, pl. 2, figs. 6–8, 1977) described from the Miocene Hatatate Formation of Sendai Area, Japan in its more subdued surface ornament with less prominent ribs, the wider and narrower anterior and posteroventral vestibula, the less numerous marginal pore canals and in having the separated teeth-like distal thickenings of the median hinge bar in the left valve. The present species is easily distinguished from *K. koreana* Huh, Whatley & Paik, 1995 (see M. Huh, R.C. Whatley & K.H. Paik, *Stereo-Atlas Ostracod Shells*, **22**, 16, 1995) from the Lower Yeonil Group of the Pohang Basin (Miocene), SE Korea by its delicate surface ornament with less prominent marginal ribs. The specimen sent to us by Ishizaki (**CNU-O-544**, Pl. **22**, 63, fig. 1; Pl. **22**, 65, fig. 3) is one of the three specimens from which he described the species in 1966. Although Ishizaki did not so designate it, it is by definition a paratype.

Distribution: Previous records are from the Pliocene of the Tatsunokunchi Formation, Sendai Area, Japan (see K. Ishizaki, 1966, *op. cit.*). We have also found it at Yongrak Village around the Mulcheonri Area near Kyongju City, where Miocene deposits of the Pohang Basin, SE Korea are exposed.

Acknowledgement: We thank Professor K. Ishizaki (Tohoku University, Sendai, Japan) for providing a type specimen and for his helpful suggestions. Support from the Basic Science Research Institute Program, Ministry of Education, Korea, 1995 is gratefully acknowledged.

Explanation of Plate 22, 65

Fig. 1, LV, ext. lat. (**CNU-O-547**, 550 μm long). Fig. 2, LV, int. lat (**CNU-O-548**, 590 μm long). Fig. 3, RV, int. lat. (paratype, **CNU-O-544**, 570 μm long).
Scale A (200 μm; ×101), figs. 1–3.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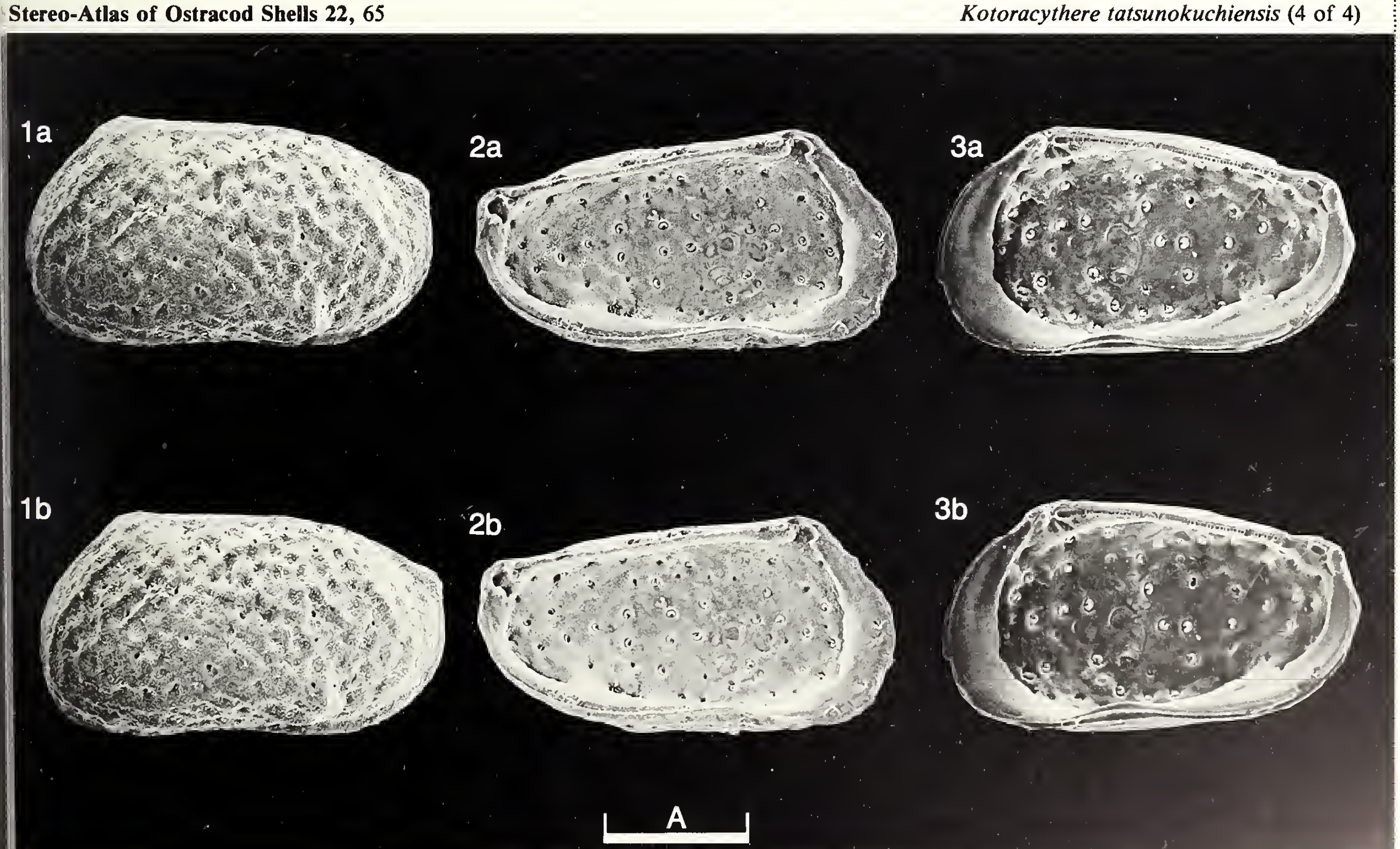
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Stereo-Atlas of Ostracod Shells 22 (16) 66–69 (1995)
595.337.14 (118.21) (519 : 161.129.36) : 551.35 + 552.54

ON *KOTORACYTHERE KOREANA* HUH, WHATLEY & PAIK sp. nov.

by Min Huh, Robin C. Whatley & Kwang-Ho Paik
(Department of Geology, Chonnam National University, Kwangju, Korea; Institute of Earth Studies, University of Wales, Aberystwyth, U.K. & Department of Earth and Environmental Sciences, Korea University, Seoul, Korea)

Kotoracythere koreana sp. nov.

1992a *Kotoracythere abnorma* Ishizaki; M. Huh & K.H. Paik, *J. geol. Soc. Korea*, **28**, 3, pl. **1**. figs. 2, 3.
1992b *Kotoracythere abnorma* Ishizaki; M. Huh & K.H. Paik, *J. paleont. Soc. Korea*, Special Publ. **1**, pl. 1, figs. 2, 3.
1994 *Kotoracythere* cf. *abnorma* Ishizaki; T. Irizuki & T. Matsubara, *J. geol. Soc. Japan*, **100**, 2, pl. **1**, fig. 2.
non 1966 *Kotoracythere abnorma* Ishizaki; K. Ishizaki, *Sci. Rep. Tohoku Univ.*, 2nd Ser. (Geol.), **37**, 2, pl. 18, figs. 10–12, text-fig. 1, 9.

Holotype: Department of Geology, Chonnam National University (**CNU**), Kwangju, Korea, no. **CNU-O-540**: ♀ carapace. [paratypes, nos. **CNU-O-540-543**]

Type locality: About 1 km northwest of Songhak Village, Hakgeondong Area, in the northwestern part of Pohang City, S.E. Korea (lat. 36° 02′ 50″ N, long. 129° 17′ 50″ E), Lower Yeonil Group of the Pohang Basin; Miocene.

Derivation of name: With reference to the occurrence of the species in the Korean Peninsula.

Figured specimens: Department of Geology, Chonnam National University (**CNU**), nos. **CNU-O-540** (holotype, ♀ carapace: Pl. **22**, 67, figs. 1, 2), **CNU-O-541** (paratype, ♀ LV: Pl. **22**, 67, fig. 3), **CNU-O-542** (paratype, ♂ LV: Pl. **22**, 69, fig. 1), **CNU-O-543** (paratype, ♀ LV: Pl. **22**, 69, figs. 2–4). All specimens from the type locality. **CNU-O-540** and **CNU-O-541** from sample HJ-1, **CNU-O-542** from HJ-3 and **CNU-O-543** from HJ-2 (Sample names after M. Huh & K.H. Paik, 1992a, b, *op. cit.*).

Explanation of Plate 22, 67

Figs. 1, 2, ♀ car. (holotype, **CNU-O-540**, 540 μm long): fig. 1, ext. rt. lat.; fig. 2, ext. lt. lat. Fig. 3, ♀ LV, ext. lat. (paratype, **CNU-O-541**, 520 μm long).
Scale A (200 μm; ×101), figs. 1, 3; scale B (200 μm; ×95), fig. 2.

Diagnosis: A medium sized, dimorphic species of *Kotoracythere*. Posterior margin more truncated in right valve than in other species of this genus. Anterior margin broadly rounded, dorsal margin slightly arched. Ornament with a reticulum comprising irregularly-shaped fossae and numerous longitudinal ribs: anterior marginal rib parallel to anterior margin with a vertical anterodorsal rib, a ventro-lateral rib and a posteroventral, acutely pointed, sub-alar protuberance. Five or six distinct longitudinal ribs occur in the posterior half of valve. Caudal process distinct. Hingement pentodont and of the *K. tatsunokuchiensis* type (M. Huh, R.C. Whatley & K.-H. Paik, *Stereo-Atlas Ostracod Shells*, **22**, 62–65, 1995); the upper part of the anterior median element in left valve rounded. Fulcral point subcircular.

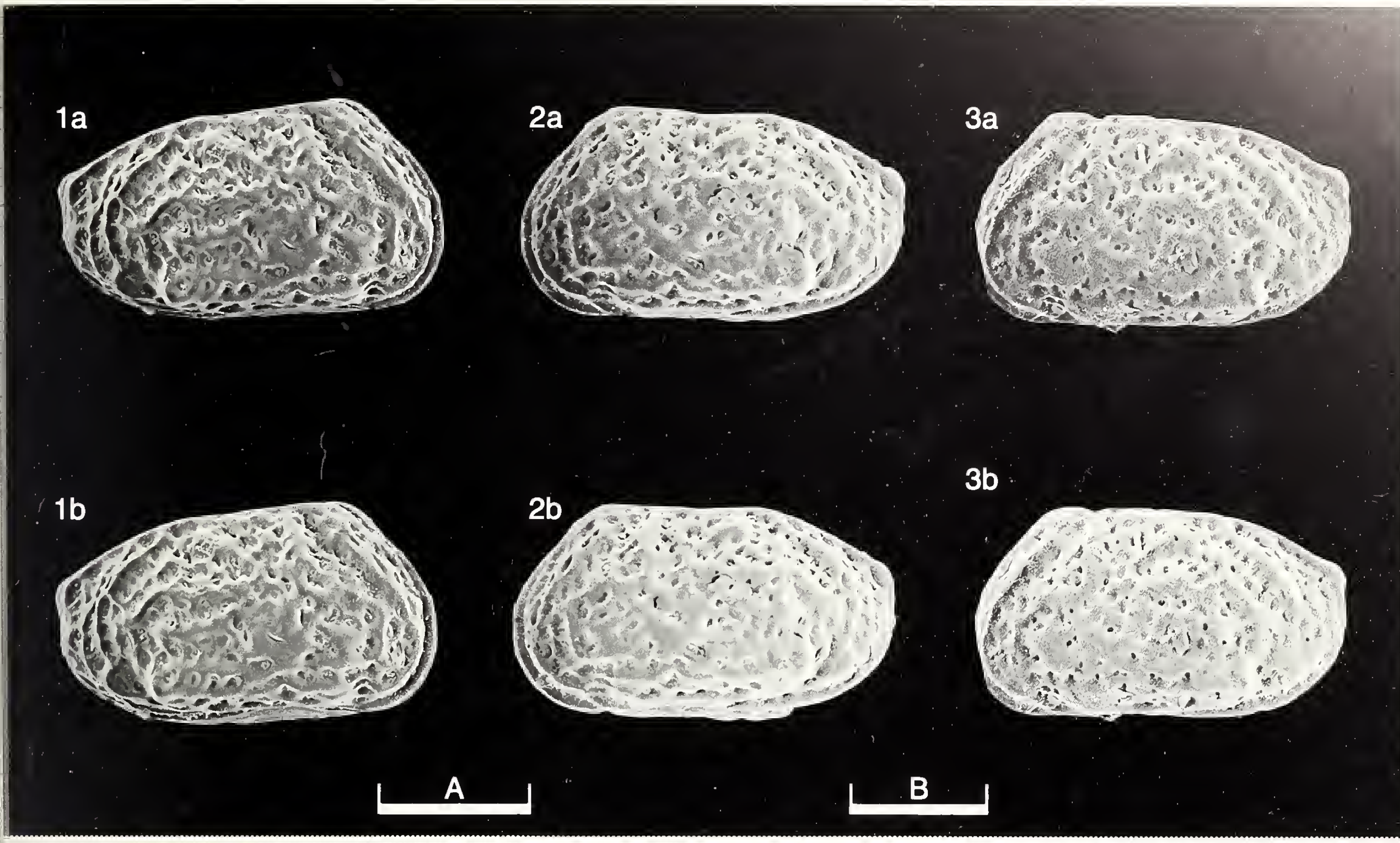
Remarks: This species is similar to the genotype of *Kotoracythere, K. abnorma* Ishizaki, 1966 (*ibid.*). (See T. Hanai *et al.*, Checklist of Ostracoda from Japan and its adjacent Seas, *Bull. Univ. Mus. Tokyo*, **12**, pl. 2, figs. 6–8, 1977) from the Miocene Hatatate Formation of Sendai Area, Japan but differs in the developmental and the distribution pattern of its ribs and the distal structure of the median hinge elements. By virtue of the separated terminal elements of the median bar, this species resembles *K. tatsunokuchiensis* Ishizaki, 1966 but the latter is easily distinguished by its delicate surface ornament with less prominent ribs. The present species also differs from *K. inconspicua* (Brady, 1880) (see L. Witte & D. Van Harten, *J. Biogeogr.* **18**, 427–436, 1991) by its less characteristic ornamentation with irregularly-shaped fossae, numerous longitudinal ribs, absence of posterior denticulations and larger size.

Distribution: Known from four samples from two localities in the Lower Yeonil Group (Miocene) of the Pohang Basin, SE Korea (for details of localities see Huh & Paik, 1992a, b, *op. cit.*).

Acknowledgement: Support from the Basic Science Research Institute Program, Ministry of Education, Korea, 1994 is gratefully acknowledged.

Explanation of Plate 22, 69

Fig. 1, ♂ LV, ext. lat. (paratype, **CNU-O-542**, 560 μm long). Figs. 2–4, ♀ LV (paratype, **CNU-O-543**, 550 μm long): fig. 2, int. lat.; fig. 3, ant. hinge; fig. 4, post. hinge.
Scale A (200 μm; ×101), figs. 1, 2; scale B (25 μm; ×424), figs, 3, 4.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ON *CAVHITHIS CAVI* SCHALLREUTER

by Roger E.L. Schallreuter
(University of Hamburg, Germany)

Genus *CAVHITHIS* Schallreuter
Type-species (by original designation): *Cavhithis cavi* Schallreuter, 1965

Diagnosis: Small (adults < 1 mm) Hithinae hollinaceans; S2 forms a cavum. No distinct preadductorial node. Posteroventral lobe distinctive in terminating posteriorly in a short spine. Velum in tecnomorphs is either markedly reduced to form a very narrow ridge anteriorly or is absent. Females with a markedly convex dolon, forming a 'false brood pouch' in anterior and central part of the ventral half of the valve. Marginal structure in right valve forms a broad, convex flange, missing in the region of the brood pouch. Surface reticulate.

Remarks: The dolon does not extend exactly to the contact plane throughout its length; posteriorly and also mid-ventrally the margin of the pouch is concave. The border of the dolon is not incomplete in the holotype as was assumed originally (R.E.L. Schallreuter, *Palaeontographica,* (A), **144**, 73, 1973). Presumably two openings are present in closed female caparaces. The function of these openings is spearlative; maybe they were to allow a stream of water for the brood in the pouch, even in closed carapaces.

Explanation of Plate 22, 71

Fig. 1, female RV ext. lat. (**AGH 142-1**, 0.70 mm long). Fig. 2, tecnomorphic RV ext. lat. (**AGH 142-2**, 0.61 mm long). Fig. 3, tecnomorphic LV ext. lat. (**AGH 142-3**, 0.60 mm long).
Scale A (100 μm; ×93), fig. 1; scale B (100 μm; ×105), figs. 2, 3.

Cavhithis cavi Schallreuter, 1965

1965 *Cavhithis cavi* sp. n., R.E.L. Schallreuter, *Ber. geol. Ges. DDR*, **10**, 482–483, pl. 10, fig. 2, text-fig. 1a–b.
1970 *Cavhithis cavi*; R.E.L. Schallreuter, *HERCA*, table 2 (pp. 290/1).
1973 *Cavhithis cavi* Schallreuter; R.E.L. Schallreuter, *Palaeontographica*, (A), **144** (1/3), 73–74, table 4, pl. 16, figs. 3–8, pl. 21, fig. 3.
1973 *Cavhithis cavi* Schallreuter; W Neben & H.H. Krueger, *Staringia*, **2**, pl. 90, fig. 6 (= R.E.L. Schallreuter 1973, pl. 16, fig. 4).
1983 *Cavhithis cavi* Schallreuter; R.E.L. Schallreuter, *Palaeontographica*, (A), **180** (4/6), 172.
1983 *Cavhithis cavi* Schallreuter; R.E.L. Schallreuter, *in* R.F. Maddocks (Ed.), *Applications of Ostracoda*, Proc. 8th Internat. Symp. Ostracoda, 659, fig. 1. Univ. Houston, Texas.
1986–7 *Cavhithis cavi* Schallreuter; E.K. Kempf, *Sonderveröff. geol. Inst. Univ. Köln*, **50**, 165, **51**, 121; **52**, 458.
1987 *Cavhithis cavi* Schallreuter; R.E.L. Schallreuter, *N. Jb. Geol. Paläont. Abh.*, **174** (1), 24.

Holotype: Geoloisch-Paläontologisches Institut, University of Greifswald, Germany, no. **15/4**; a female left valve.

Type locality: A glacial erratic boulder (geschiebe) from Teschenhagen, near Stralsun, Pomerania; lat. 54° 18.8′ N, approximately long. 13° 7.2′ E. Lower Upper Viruan (C_3/D_1; = Caradoc) 'series'.

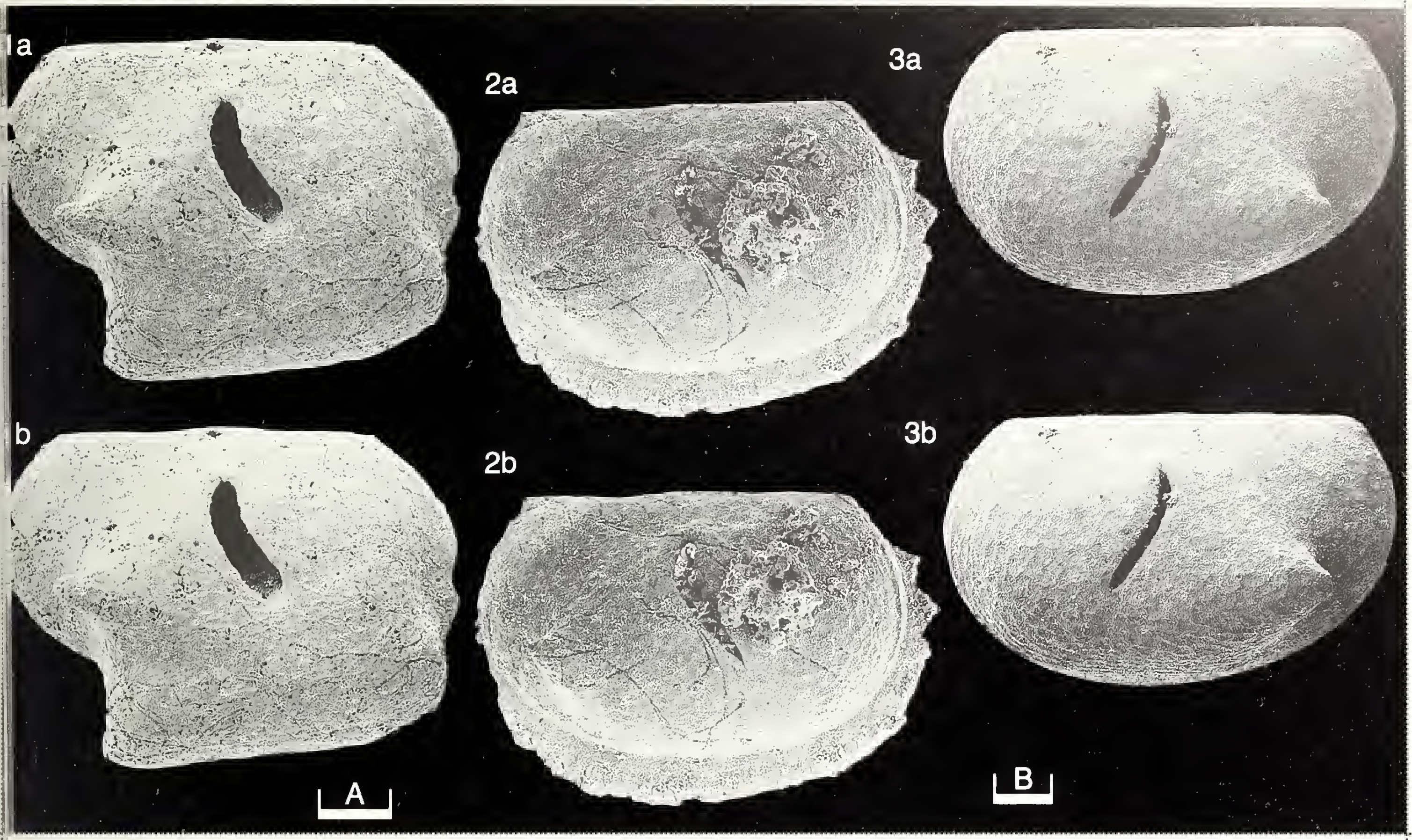
Figured specimens: Archiv für Geschiebekunde, Geologisch-Paläontologisches Institut und Museum, University of Hamburg (**AGH**), Germany, nos. **G 142-1** (♀ RV: Pl. **22**, 71, fig. 1), **G 142-2** (tecnomorphic RV: Pl. **22**, 71, fig. 2), **G 142-3** (tecnomorphic LV: Pl. **22**, 71, fig. 3), **G 142-4** (♀ RV: Pl. **22**, 73, fig. 1), **G 142-5** (tecnomorphic RV: Pl. **22**, 73, fig. 2) and **G 142-6** (♀ LV: Pl. **22**, 73, fig. 3). All from lower Upper Viruan Backsteinkalk geschiebe no. Jas17, from the beach at Rixhöft, Jastrzebia Góra, Poland approx. lat. 54° 51′ N, long. 18° 18′ E; collected by the author in 1985 (R.E.L. Schallreuter 1987, *op. cit.*, 24–25).

Diagnosis: As for genus, which is presently monotypic.

Distribution: Baltic types of the early Late Viruan (C_3/D_1; = Caradoc) 'series', Ordovician, Backsteinkalk geschiebes of northern Central Europe.

Explanation of Plate 22, 73

Fig. 1, female RV int. lat. (**AGH 142-4**, 0.71 mm long). Fig. 2, tecnomorphic RV int. lat. (**AGH 142-5**, 0.42 mm long). Fig. 3, posteriorly incomplete female LV (**AGH 142-6**, > 0.64 mm long).
Scale A (100 μm; ×100), figs. 1, 3; scale B (100 μm; ×150), fig. 2.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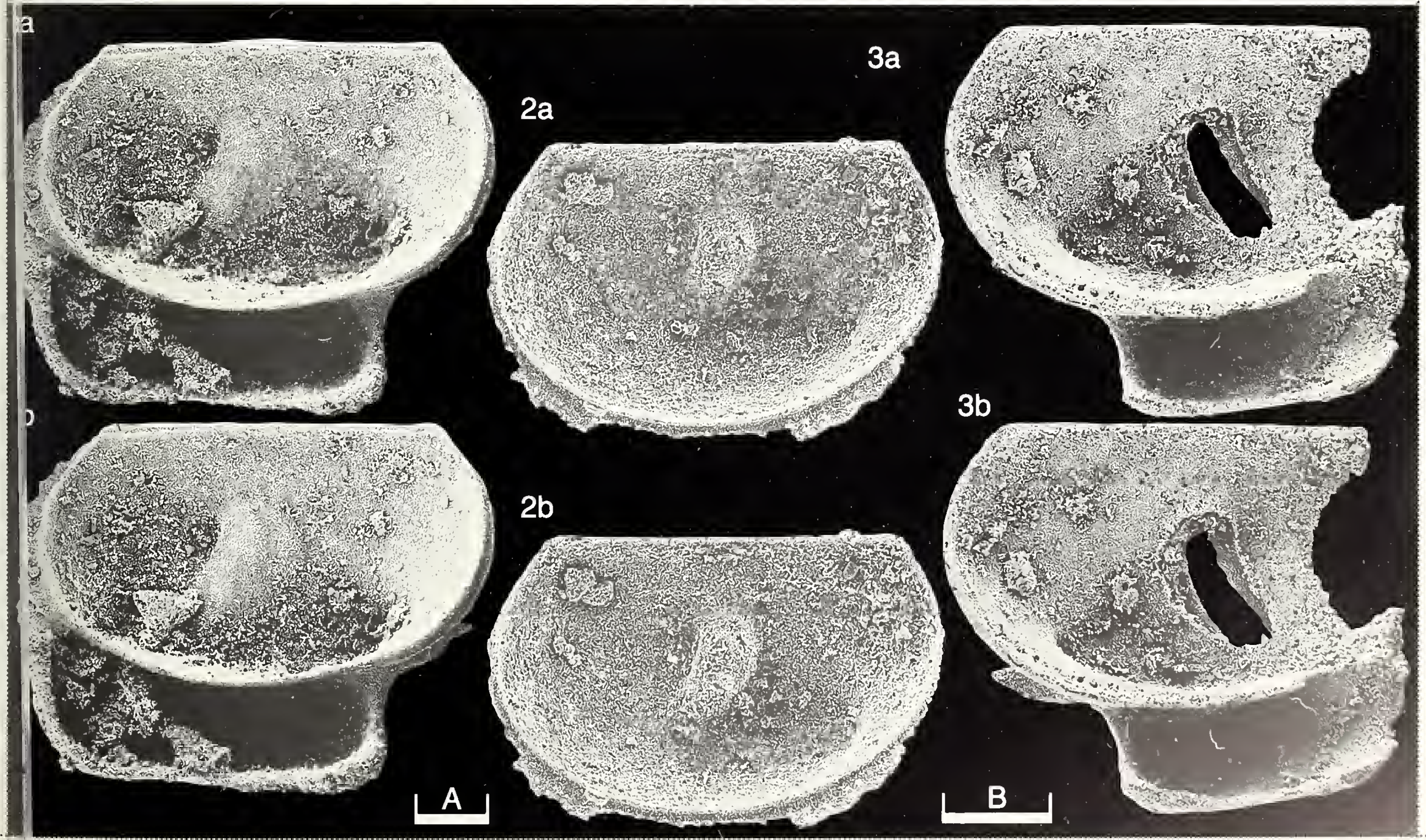
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ON *SPINODIPHORES PRAEPLETUS* SCHALLREUTER gen. et sp. nov.

by Roger E.L. Schallreuter
(University of Hamburg, Germany)

Genus *SPINODIPHORES* gen. nov.
Type-species: *Spinodiphores praepletus* gen. et sp. nov.

Derivation of name: From Latin, *spina*, spine and *nodus*, node; plus suffix *-phores* as in *Klimphores*; gender, masculine.

Diagnosis: Elongate, preplete bollid drepanellacean; free margin centroventrally very slightly concave to slightly convex. In dorsal half, anteriorly, an oval node occurs at some distance from dorsal margin; posteriorly, and closer to dorsal margin, a short spine occurs and may protrude beyond the hinge line. The node and spine are joined by an indistinct, flat, broad connecting lobe. Bend at junction of lateral and marginal surfaces has an indistinct, rounded pseudovelum. Valve surface reticulate.

Remarks: This genus is characterized by its preplete outline, reticulation and by the size, shape and development of its dorsal nodes. In its centrodorsal node and spine *Spinodiphores* resembles certain species of *Pseudulrichia*, for example *P. ullehmanni* Schallreuter, 1981 (*Geol. För. Stockh. Förh.*, **103**, 69, fig. 9) or *P.* sp. aff. *norvegiva* of Blumenstengel, 1965 (*Freiberger ForschHft.*, (C) **182**, 69, fig. 13, pl. 1, fig. 3). *Spinodiphores* differs fundamentally by its elongate shape, preplete outline, its sometimes slightly concave centroventral margin, its steeper marginal surface, weak pseudovelum and reticulation.

In its steep marginal surface and the development of the pseudovelum *S. praepletus* resembles the Ordovician type-species *Klimphores planus* Schallreuter, 1966 (see R.E.L. Schallreuter, *Stereo-Atlas Ostracod Shells*, **7**, 9, 1980). In contrast to *Spinodiphores* the outline of *K. planus* is more or less amplete and the nodes are much larger and not spine-like.

Explanation of Plate 22, 75

Fig. 1, LV ext. lat. (paratype, **GPIMH 3653f**, 475 μm long). Fig. 2, LV ext. lat. (holotype, **GPIMH 3653d**, 473 μm long). Fig. 3, LV ext. lat. (paratype, **GPIMH 3653e**, 512 μm long).
Scale A (100 μm; ×141), figs. 1, 2; scale B (100 μm; ×132), fig. 3.

The Silurian *Klonkina* Kruta (*Neues Jb. Geol. Paläont Mh.*, **1986**, 444, fig. 1) differs in its anterior node which is also spine-like and situated close to the dorsal margin like the posterior spine (see also R.E.L. Schallreuter, *Neues Jb. Geol. Paläont. Mh.*, **1991**, 110, figs. 3.1–2). The Silurian *Sekobollia* Schallreuter (*N. Jb. Geol. Paläont. Mh.*, **1991**, 111, figs. 4.1, 4.2) also possesses an anterior node and a posterior spine, but they are connected by a distinct zygal ridge and the anterior node is not sited away from the dorsal margin as in *Spinodiphores*; the two genera also differ in outline and development of the pseudovelum.

Spinodiphores is placed within the Bolliidae though its outline, position of the anterior node and the development of the zygal ridge ('connecting lobe') are atypical. A concave centroventral free margin (ventricular concavity; G. Henningsmoen, *Geol. För. Stockh. Förh.*, **86**, 391, 1965) also occurs (but rarely) in other bolliids, for example in *Quasibollia* Warshauer & Berdan, 1982 (see F.M. Swain & J.R. Cornell, *Rep. Invest., Minn. geol.*, **35**, pl. 1, figs. 6a–b, 1987).

Spinodiphores praepletus sp. nov.

Holotype: Geologisch-Paläontologisches Institut und Museum, University of Hamburg (**GPIMH**), Germany no. **3653d**. [Paratypes: **GPIMH 3653a–c, 3653e–g**].

Type locality: Rio Sassito, W of San Juan, Argentina; approximately lat. 31° 31.3′ S, long. 68° 57.7′ W. Llandeilo or lower/middle Caradoc 'series', Ordovician.

Derivation of name: Alluding to the preplete outline of the valves.

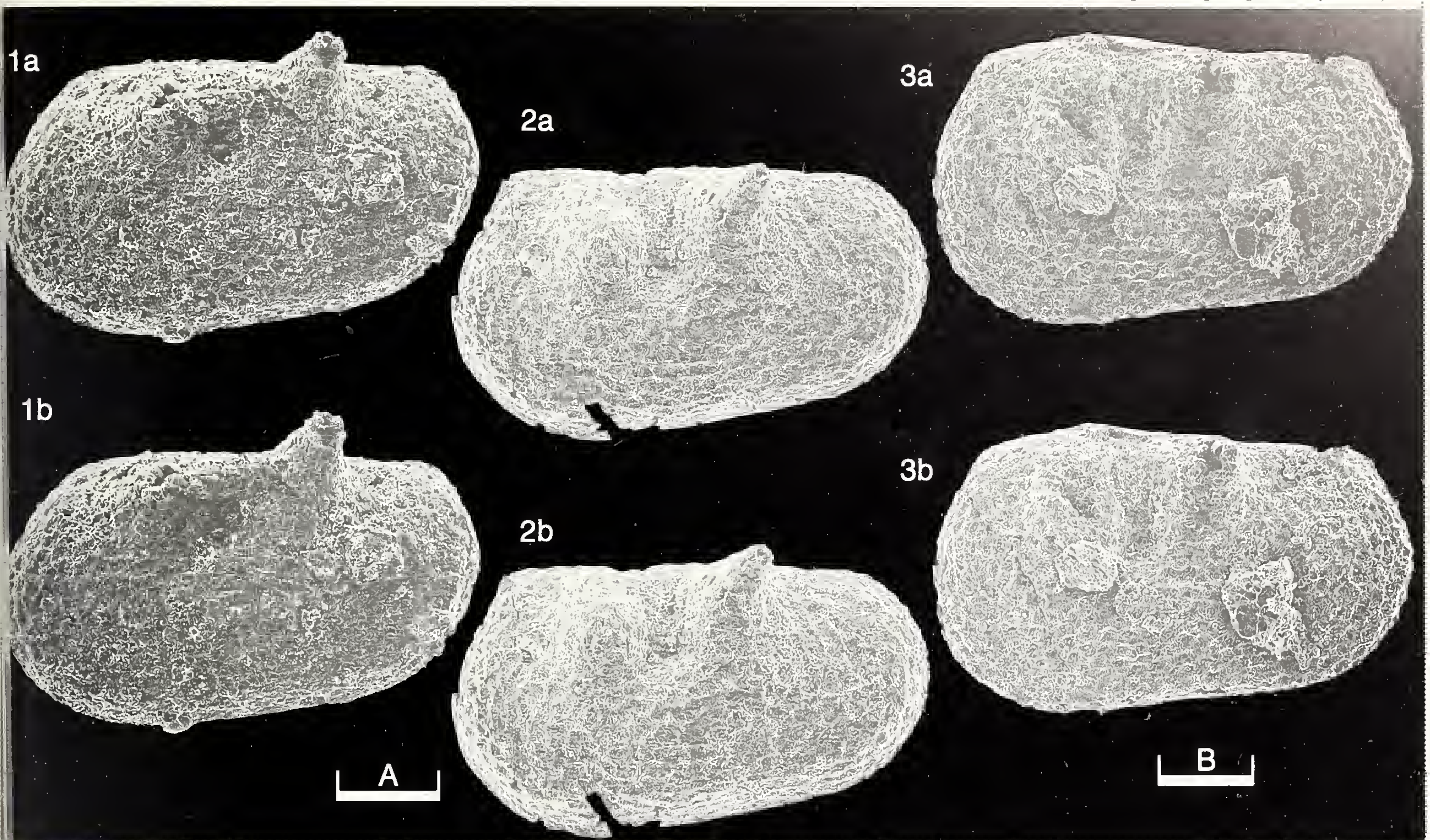
Diagnosis: As for the genus, which is presently monotypic.

Figured specimens: University of Hamburg **GPIMH** nos. **3653a** (paratype, LV: Pl. **22**, 77, fig. 1), **3653b** (paratype, RV. Pl. **22**, 77, fig. 3), **3653c** (paratype, RV: Pl. **22**, 77, fig. 2), **3653d** (paratype, LV: Pl. **22**, 75, fig. 2), **3653e** (paratype, LV: Pl. **22**, 75, fig. 3) and **3653f** (paratype, LV: Pl. **22**, 75, fig. 1). All are from type locality (sample AP Bg 206 LF). The material is silicified.

Distribution: Known only from the type locality, Ordovician of Argentina.

Explanation of Plate 22, 77

Fig. 1, LV ext. lat. (paratype, **GPIMH 3653a**, 510 μm long). Fig. 2, RV ext. lat. (paratype, **GPIMH 3653c**, 390 μm long). Fig. 3, RV ext. lat. (paratype, **GPIMH 3653b**, 465 μm long).
Scale A (100 μm; ×126), fig. 1; scale B (100 μm; ×172), fig. 2; scale C (100 μm; ×144), fig. 3.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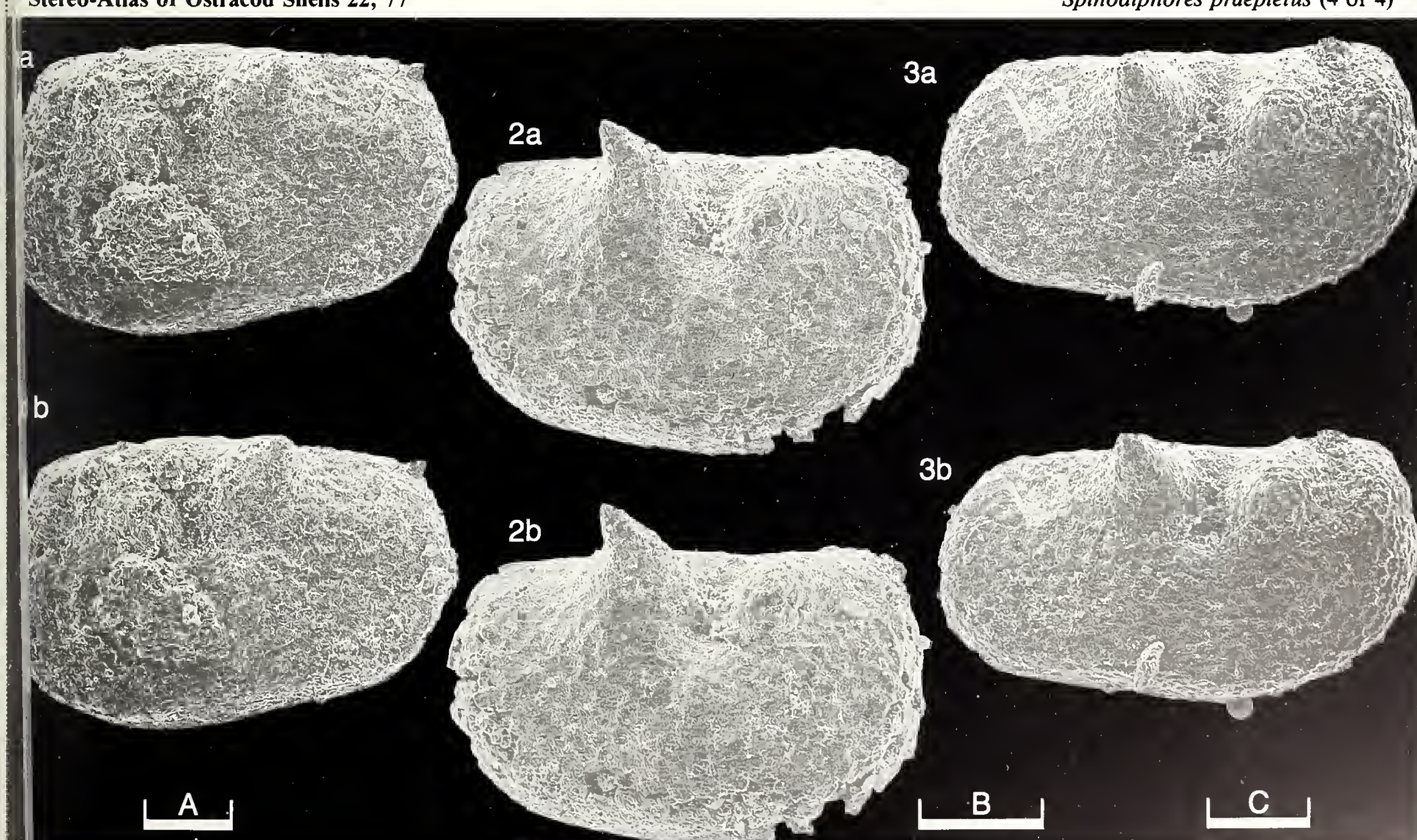
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ON *ANSIPE ANSERIPEDICULUS* SCHALLREUTER gen. et sp. nov.

by Roger E.L. Schallreuter
(University of Hamburg, Germany)

Genus *ANSIPE* gen. nov.
Type-species: *Ansipe anseripediculus* gen et sp. nov.

Derivation of name: Formed artificially from name of the type-species.

Diagnosis: Elongate, rounded-rectangular, subamplete to slightly preplete bollid drepanellacean. In dorsal half, slightly closer to anterior end, two small ridge-like nodes occur parallel to each other, vertical to dorsal margin or slightly oblique in anteroventral direction. No additional nodes. Parallel to free margin, at the confluence of the lateral and marginal surfaces, is a ridge-like pseudovelum. Lateral surface, except for nodes, is punctate.

Remarks: *Retinoda* Schallreuter (*Stereo-Atlas Ostracod Shells*, **13**, 21–24, 1986), from the upper Ordovician of Europe (Thuringia, Baltoscandia), is characterized by two, large, bulbous nodes.

In *Warthinia* Spivey, 1939 from the upper Ordovician of North America and Europe (Bohemia, Baltoscandia), the two dorsal nodes are rounded, sometimes developed as spines (for example, see Warshauer, S.M. & Berdan, J.M., *Prof. Pap. U.S. geol. Surv.*, **1066-H**, pl. 2, figs. 9–10, 1982) and are of different sizes, the posterior node being larger than the anterior node. In *W. lauta* (Gailite, L.K., *Paleont. stratigr. Pribaltiki Belorussii*, **3**: pl. 2, fig. 4, 1971) the differences in the size of the nodes is not as much as in *W. saccula* (Burr & Swain, *Minn. geol. Surv.*, SP-3, 1965). Furthermore, in *Warthinia* more than one node is developed in the anterior part of the valve (Warshauer, S.M. & Berdan, J.M., *op. cit.*, pl. 1, figs. 12–21).

Explanation of Plate 22, 79

Fig. 1, LV ext. lat. (paratype, **GPIMH 3652c**, 564 μm long). Fig. 2, LV ext. lat. (holotype, **GPIMH 3652g**, 465 μm long). Fig. 3, LV ext. lat. (paratype, **GPIMH 3652d**, 390 μm long).
Scale A (100 μm; ×115), fig. 1; scale B (100 μm; ×145), fig. 2; scale C (100 μm; ×175), fig. 3.

In *Klimphores* Schallreuter, 1966 the two main nodes may be elongate but in such cases they are not parallel to each other as they are in *Ansipe* (Schallreuter, R.E.L.), *Stereo-Atlas Ostracod Shells*, **7**, 9–16, 1980; L.K. Gailite, 1971, *op. cit.*, pl. 1, figs. 1–5).

Lardeuxella Vannier (*Palaeontographica* (A), **193**, 1986 (pl. 2, figs. 4, 5, pl. 3, figs. 1–5, pl. 4, figs. 1, 2)) is, in its two ridge-like, parallel lobes and the ridge-like pseudovelum, very similar to *Ansipe* but it differs in having lobes that are very long and which extend to the ventral part of the valve. Such long lobes are atypical for the bolliids; therefore, *Lardeuxella* is best assigned to the Quadrijugatoridae. *Ansipe* also differs from *Lardeuxella* by its punctation.

Ansipe anseripediculus sp. nov.

Holotype: Geologisch-Paläontologisches Institut und Museum, University of Hamburg (**GPIMH**), Germany, no. **3652g**. [Paratypes: **GPIMH 3652a–3652f**].

Type locality: Rio Sassito, W of San Juan, Argentina, approximately lat. 31°31.3′ S, long. 68°57.7′ W. Llandeilo or lower/middle Caradoc 'series', Ordovician.

Derivation of name: Latin, *anser*, goose, and *pediculus*, small foot; alluding to the similarity of the two elongate centrodorsal nodes with quotation-marks (German: Gänsefüßchen).

Diagnosis: As for the genus, which is presently monotypic.

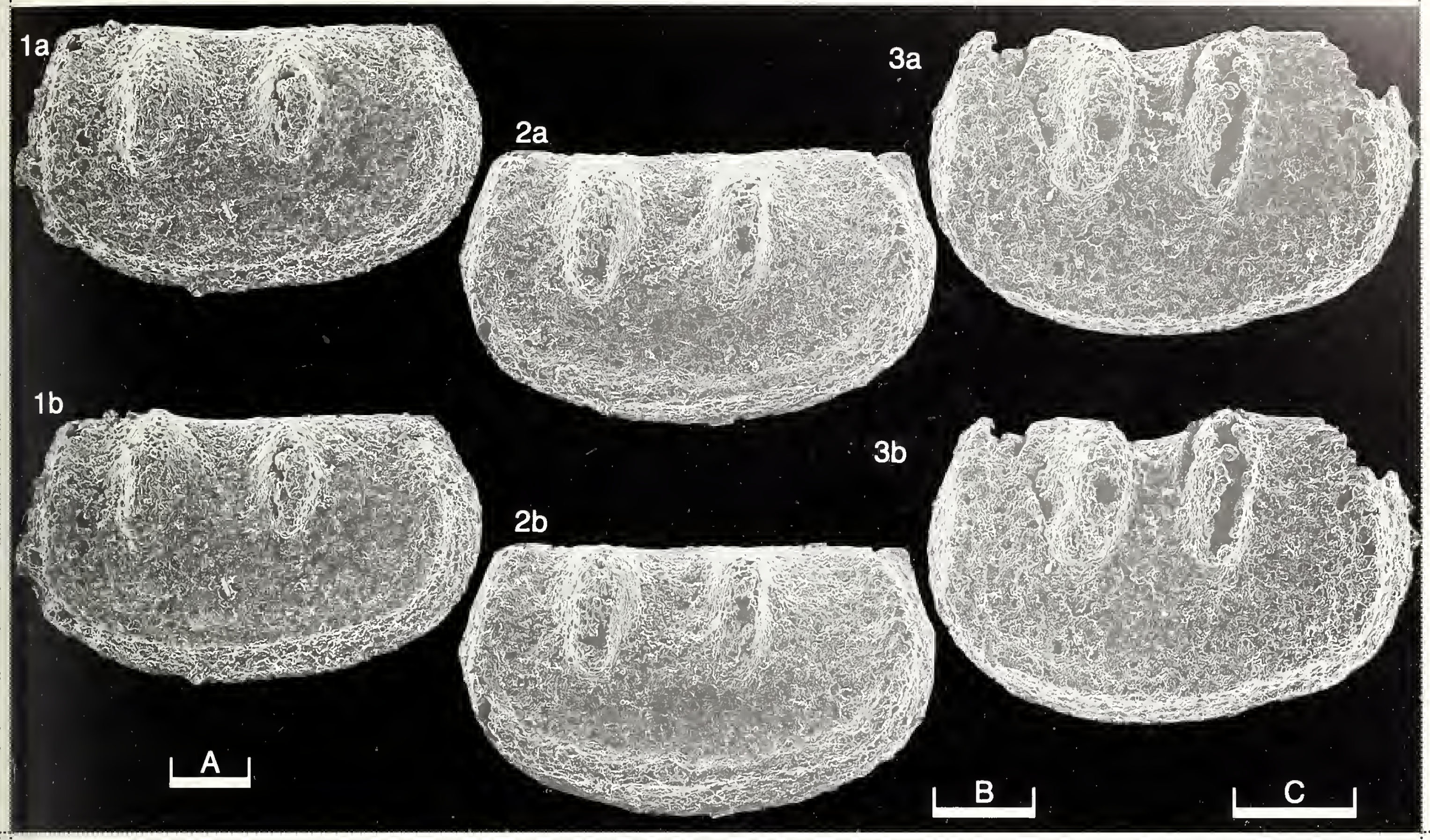
Figured specimens: University of Hamburg, **GPIMH** nos. **3652a** (paratype, RV: Pl. **22**, 81, fig. 1), **3652b** (paratype, RV: Pl. **22**, 81, fig. 2), **3652c** (paratype, LV: Pl. **22**, 79, fig. 1), **3652d** (paratype, LV: Pl. **22**, 79, fig. 3), **3652f** (paratype, RV: Pl. **22**, 81, fig. 3) and **3652g** (holotype, LV: Pl. **22**, 79, fig. 2). All are from the type locality (sample AP Bg 206 LF). The material is silicified.

Remarks: *Retinoda sulcata* Schallreuter, 1986, from the Caradoc of Thuringia, possesses rounded dorsal nodes and a more rounded outline (Schallreuter, *op. cit.*, pls. 13, 22, 13, 24).

Distribution: Known only from the type locality, Ordovician of Argentina.

Explanation of Plate 22, 81

Fig. 1, RV ext. lat. (paratype, **GPIMH 3652a**, 529 μm long). Fig. 2, RV ext. lat. (paratype, **GPIMH 3652b**, 543 μm long). Fig. 3, RV ext. lat. (paratype, **GPIMH 3652f**, 537 μm long).
Scale A (100 μm; ×124), figs. 1–3.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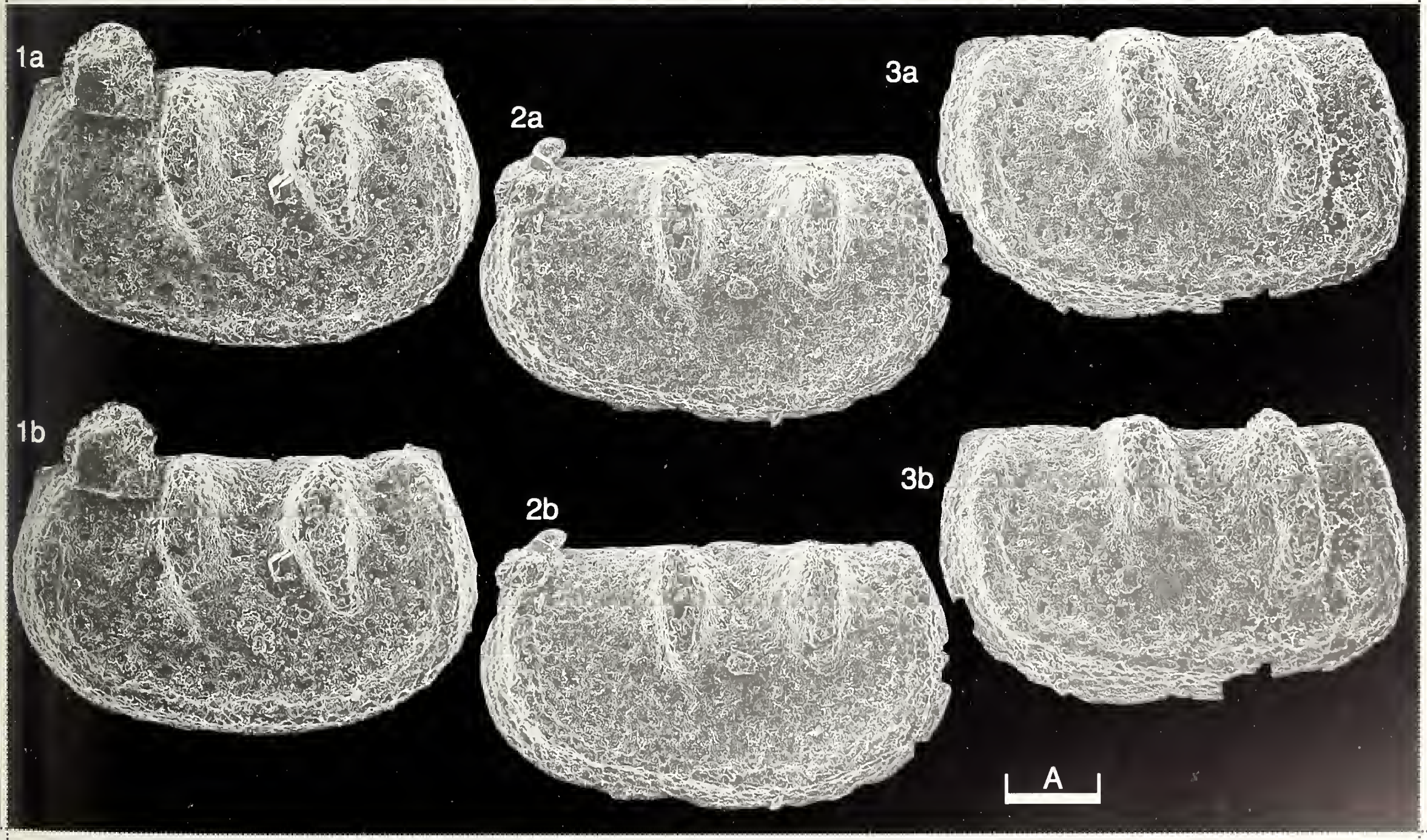
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ON *HARPABOLLIA ARGENTINA* SCHALLREUTER sp. nov.

by Roger E.L. Schallreuter
(University of Hamburg, Germany)

Harpabollia argentina sp. nov.

Holotype: Geologisch-Paläontologisches Institut und Museum, University of Hamburg (**GPIMH**), Germany, no. **3651b**. [Paratypes: **GPIMH 3651a, 3651c–g**].

Type locality: Rio Sassito, W of San Juan, Argentina, approximately lat. 31°31.3′S, long. 68°57.7′W. Llandeilo or lower/middle Caradoc 'series', Ordovician.

Derivation of name: After the country of origin of the species.

Diagnosis: Species of *Harpabollia* up to at least 0.47 mm long. Anterior branch of inner, horseshoe-like (zygal) lobe is dorsally bulb-like (L2). Posterior, crescent-shaped area, behind the outer horseshoe-shaped ridge, is small.

Figured specimens: University of Hamburg, **GPIMH** nos. **3651a** (paratype, RV: Pl. **22**, 83, fig. 3), **3651b** (holotype, RV: Pl. **22**, 83, fig. 2), **3651c** (paratype, RV: Pl. **22**, 85, fig. 2), **3651d** (paratype, LV: Pl. **22**, 83, fig. 1), **3651e** (paratype, RV: Pl. **22**, 85, fig. 3) and **3651f** (paratype, LV: Pl. **22**, 85, fig. 1). All are from the type locality (sample AP Bg 206 LF). The material is silicified.

Remarks: The type-species of *Harpabollia* Schallreuter (*Neues Jb. Geol. Paläont. Mh.*, **1990** (2), 121), *Bollia harparum* (Troedsson, *Lunds Univ. Årsskr. N.F.*, (2) **15** (3), 55, 92, 1918; = *Bollia mezvagarensis* Gailite, *Paleont. Stratigr. Pribaltiki Belorussii*, **2**, 23, 1970) from the Late Ordovician of Baltoscandia (Scania, Latvia, East Prussia), Bohemia and the Carnic Alps, differs by its less bulb-like L2 and by having a broader posterior area behind the outer horseshoe-shaped ridge (Schallreuter 1990, *op. cit.*, fig. 2).

Explanation of Plate 22, 83

Fig. 1, LV ext. lat. (paratype, **GPIMH 3651d**, 440 μm long). Fig. 2, RV ext. lat. (holotype, **GPIMH 3651b**, 471 μm long). Fig. 3, RV ext. lat. (paratype, **GPIMH 3651a**, 369 μm long).
Scale A (100 μm; ×150), fig. 1; scale B (100 μm; ×143), fig. 2; scale C (100 μm; ×175), fig. 3.

The homeomorphic *Satiellina* Vannier, 1986 (*Palaeontographica*, (A), **193**, 106) resembles *Harpabollia* but in *Satiellina* the pseudovelum is missing anteriorly and posteriorly or only weakly developed. *Harpabollia* is placed within the Quadrijugatoridae whereas *Satiellina* seems to be a member of the Circulinidae, a taxon which is characterized by normally rather high to very high valves and relatively flat marginal surfaces.

In *Quasibollia* Warshauer & Berdan, 1982 (*Prof. Pap. U.S. geol. Surv.*, **1066**, H19), from the upper Ordovician of N America and Kazakhstan, the central horseshoe-shaped lobe is more or less dissolved into single nodes (*op. cit.*, pl. 1, figs. 1–11; Melnikova, L.M., *Trudy Paleont. Inst. Akad. nauk SSSR*, **218**, pl. 8, fig. 6, 1986).

Very similar to *H. argentina* and a possible species of *Harpabollia* is *Bollia ungula* Swartz & Swain, 1941, from the middle Devonian of N America (*Bull. geol. Soc. Am.*, **52**). In *B. ungula* the anterior node is less bulb-like than in *H. argentina* (see Swartz & Swain 1941, pl. 2, fig. 4; Scott H.W. & Wainwright J. *in* Moore, R.C. (ed.), *Treatise on Invertebrate Paleontology, pt. Q*, figs. 62.2, 1961).

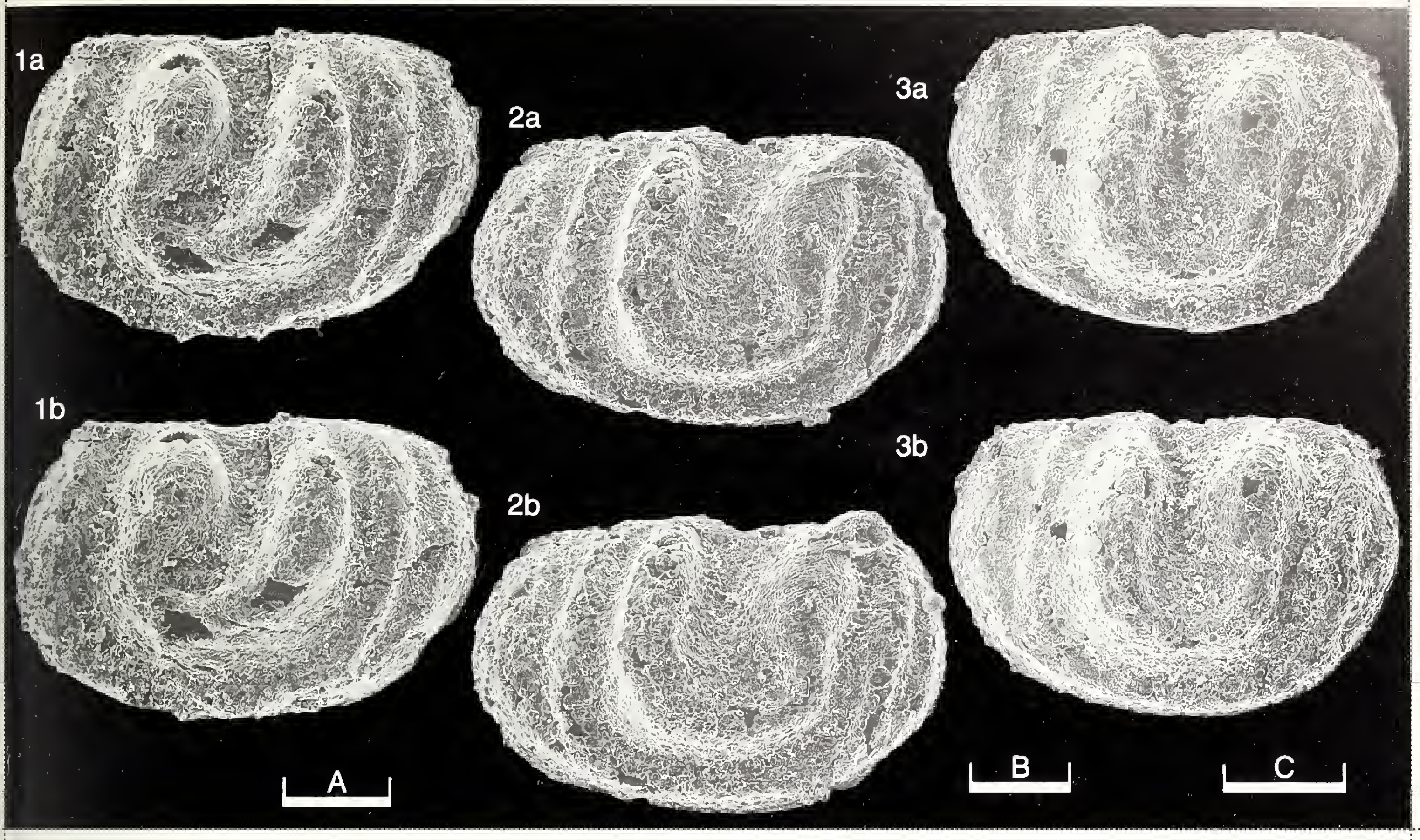
H. argentina occurs together with *Ansipe anseripediculus* and *Spinodiphores praepletus* (both Schallreuter 1995, *Stereo-Atlas Ostracod Shells*, **22**, 74–77, 78–81, 1995). These three species form the main part of the ostracod fauna. The remaining species consist of only a few, also small, largely unsculptured forms. Larger ostracods, especially palaeocopes, were not found; thus, the fauna possibly attests to unusual environmental and/or sedimentary conditions.

H. argentina represents the first record of the genus outside Europe and indicates faunal relations between South America and Europe in middle Ordovician time. *Harpabollia* is a member of the Quadrijugatoridae, a typical North American family. Thus, faunal links with this continent may also be indicated by the new species.

Distribution: Known only from type locality, Ordovician of Argentina.

Explanation of Plate 22, 85

Fig. 1, LV ext. lat. (paratype, **GPIMH 3651f**, 420 μm long). Fig. 2 RV, ext. lat. (paratype, **GPIMH 3651c**, 374 μm long). Fig. 3 RV, ext. lat. (paratype, **GPIMH 3651e**, 402 μm long).
Scale A (100 μm; ×160), fig. 1; scale B (100 μm; ×170), figs. 2, 3.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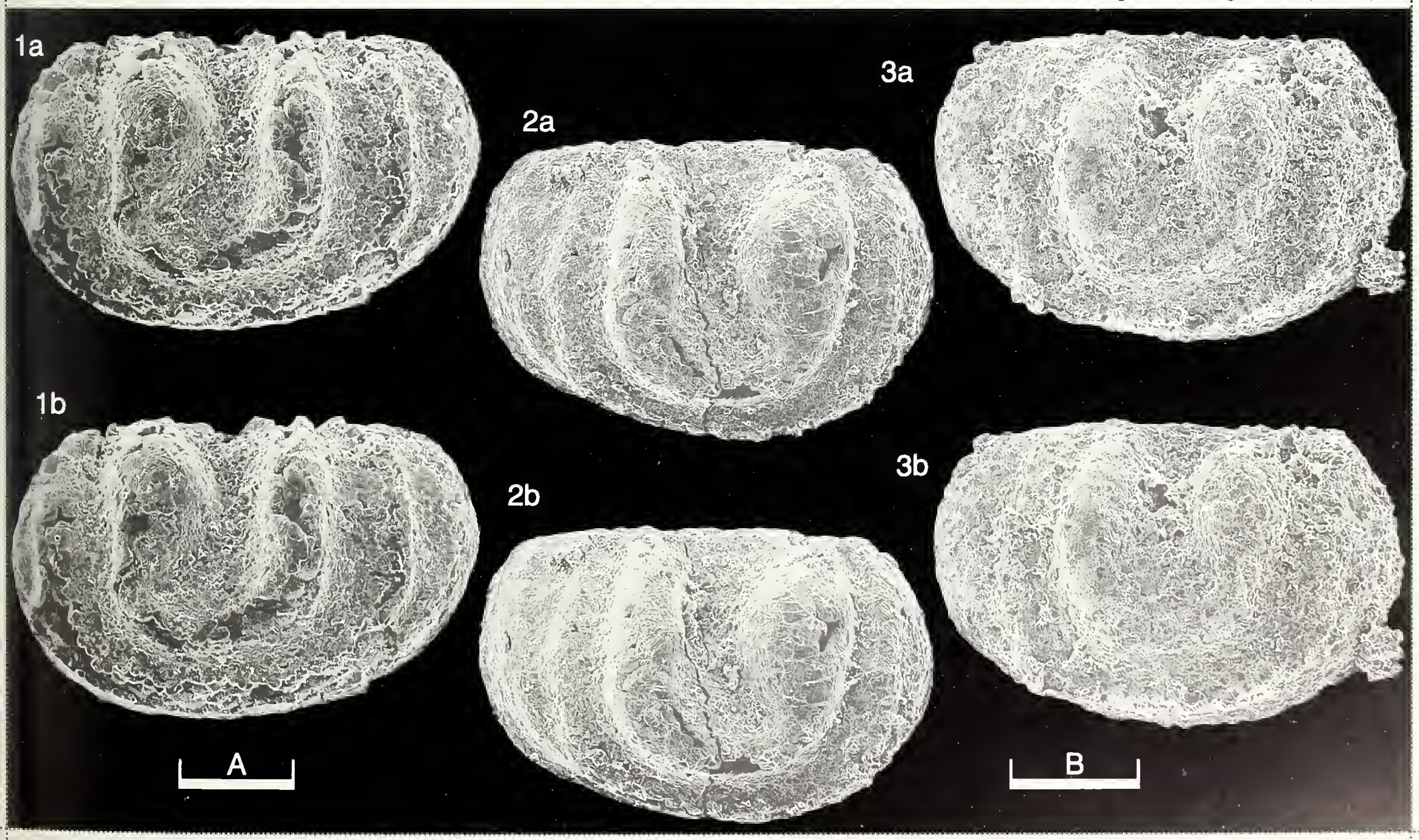
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ON *JURALEBERIS JUBATA* VANNIER & SIVETER gen. et sp. nov.

by Jean Vannier & David J. Siveter
(Université Claude Bernard, Lyon, France & University of Leicester, England)

Genus *JURALEBERIS* gen. nov.
Type-species: *Juraleberis jubata* gen. et sp. nov.

Derivation of name: Jura, as in Jurassic and *leberis*, skin; alluding to its age. Feminine.

Diagnosis: Large cylindroleberidid myodocopid (carapace >3 mm long) with almost subcircular outline. Second antenna has tripartite protopodite bearing tiny medial node. Mandible with long, wide, upwardly directed basipodite. Maxilla has subquadrangular basipodite. 5th limb exopodite is crescent-shaped overall, with acute dorsal end and >70 radiating bristles (ventral bristles stout, curve towards centre of domicilium); exopodite is smooth, spatulate, exsagittal feature. 7th limb is very flexible, slender; diameter proximally *c.* 80 μm.

Remarks: Many protrusive soft parts of *Juraleberis* are lacking. Nevertheless, *Juraleberis* clearly shows affinities with Recent cyclasteropine cylindroleberidids such as *Leuroleberis* Kornicker, 1981 and *Cycloleberis* Skogsberg, 1920 (e.g. *Cycloleberis squamiger* (Scott, 1894); see Kornicker, L., *Smithson. Contr. Zool.*, **197**, 1975 and **319**, 1981) and is tentatively assigned to that subfamily. Characteristics common to these genera include an evenly rounded carapace outline and a spatula-shaped 5th limb exopodite. The mandibles, maxillae basipodites and 5th limb exopodites of *Juraleberis* (Text-fig. 1) are relatively larger than in other cylindroleberines.

Juraleberis is the oldest known cylindroleberidid. We concur that *Triadocypris spitzbergensis* Weitschat (*Paläont. Z.*, **57**, 309–323, 1983), from the Triassic of Spitzbergen, is a cypridinid, although its gill-like features suggest similarities with the Cylindroleberididae. In the absence of soft part evidence the systematic position of possible Cylindroleberididae

Explanation of Plate 22, 87

Figs. 1–4, carapace, lt. valve removed, showing soft anatomy (holotype, **PIN 3775/1**, 3.3 mm long and 2.8 mm high): fig. 1, lt. lat.; fig. 2, lt. lat., epipodite of lt. 5th limb; fig. 3, vent. obl., bristles of epipodite of lt. 5th limb; fig. 4, vent. obl., bristles and interdigitated setae of epipodite of lt. 5th limb.

Scale A (1000 μm; ×15), fig. 1; scale B (250 μm; ×30) fig. 2; scale C (250 μm; ×60), fig. 3; scale D (10 μm; ×957), fig. 4.

Müller, 1906 from the Palaeozoic, such as *Eocypridina aciculata* Scott & Summerson, 1943 (see Kornicker, L., *Smithson. Contr. Zool.*, **319**, 39, 1981), cannot be confirmed. That notwithstanding, we consider that the supposed concavicarid arthropod *Concavicaris remipes* Schram (*Proc. San Diego Soc. nat. Hist.*, **3**, 1990), from the Carboniferous Mazon Creek Lagerstätte, is probably an ostracod of possible cypridinid or cylindroleberidid affinities; this is indicated by its carapace size (*c.* 10 mm long), rostrum and furcal lamella.

Juraleberis jubata sp. nov.

1978 *Cycloleberis* sp.; J. Dzik, *Neues. Jb. Geol. Paläont. Mh.*, **7**, 393, figs. 1–3.

Holotype: Palaeontological Institute (PIN), Russian Academy of Sciences, Moscow, Russia, no. **3775/1**; an incomplete carapace (most of left valve and part of right valve missing) with preserved soft parts.

Type locality: Savelesky Mine, near Pugatchov, Saratov district, Volga River region, Russia; early Volgian (Tithonian), Upper Jurassic.

Derivation of name: From Latin, *jubatus*, maned; fanciful resemblance of the epipodite of the 5th limb to the mane of a horse.

Figured specimens: Palaeontological Institute, Moscow, no. **3775/1** (holotype, carapace with soft anatomy: Pl. **22**, 87, figs. 1–4; Pl. **22**, 89, figs. 1–5; Pl. **22**, 91, figs. 1–4; Pl. **22**, 93, figs. 1–6). From type locality.

Diagnosis: As for the genus, which is currently monotypic.

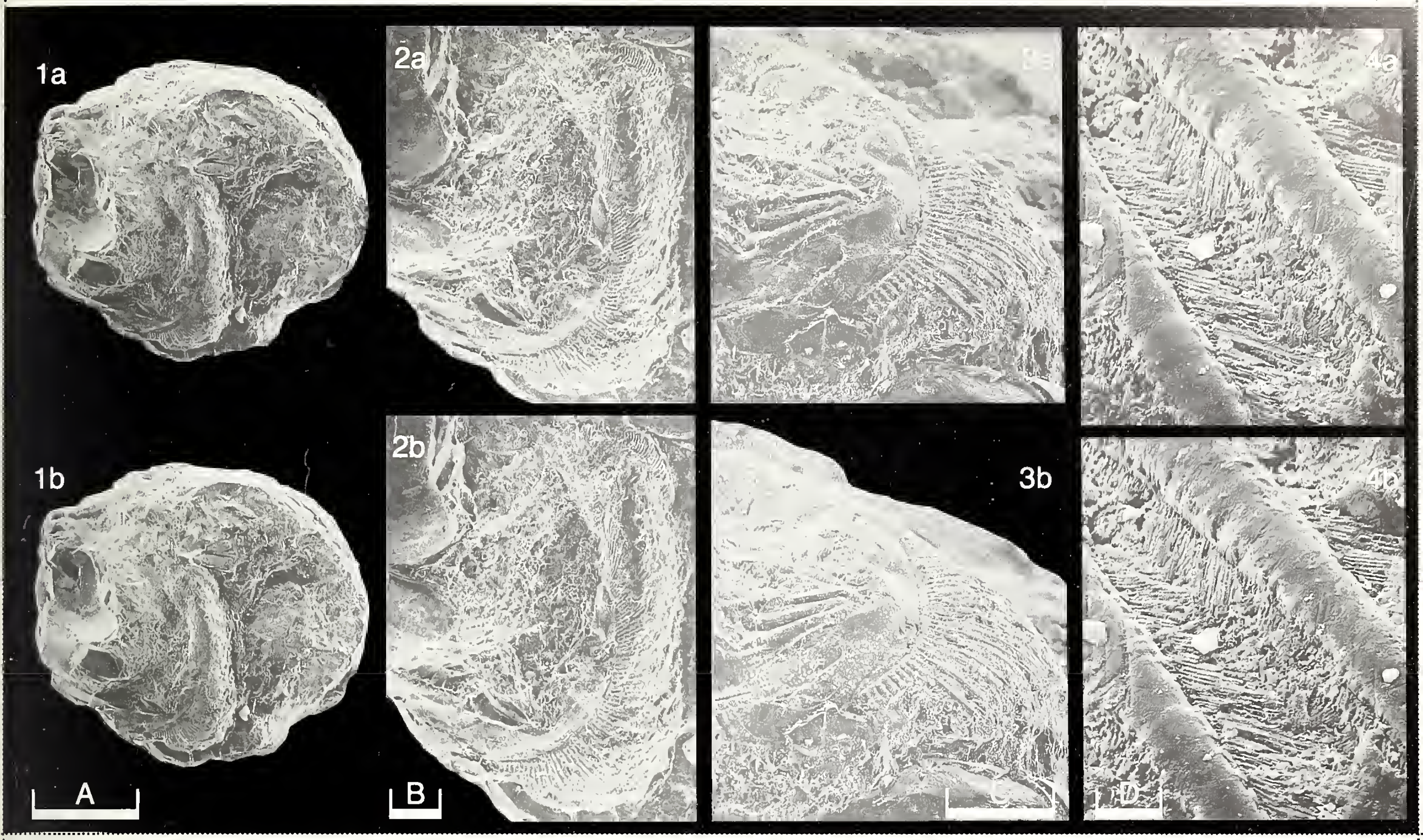
Remarks: (a) *Preservation*: This species is known only from the holotype, which was prepared by needles after recovery, by acid treatment, from a concretion containing a pliosaur reptile (Dzik 1978). Several other ostracod specimens were extracted from the rock matrix (Dzik, pers. comm., 1995) but could not be located in the collections in Moscow (DJS 1995).

The concretion also yielded abundant coleoid hooks; thus, the ostracods may represent part of the stomach contents of the pliosaur (Dzik, 1978). These particular taphonomic conditions probably account for the early phosphatization and preservation of the ostracod soft parts (see Wilby, P.R. & Martill, D.M., *Hist. Biol.*, **6**, 25–36, 1992 for analogous exceptional preservation in fossil fish stomachs). Secondary phosphatization is also responsible for exceptional

Explanation of Plate 22, 89

Figs. 1–5, carapace, lt. valve removed, showing soft anatomy (holotype, **PIN 3775/1**, 3.3 mm long): fig. 1, lt. lat., possible remains of gill attachment overhanging distal part of lt. 7th limb; fig. 2, slightly vent. obl., distal part of lt. 7th limb; fig. 3, ant., showing (from lt. to rt.) protopodites of 2nd antennae, basipodites of mandibles, and exopodites of 5th limbs; fig. 4, lat., bristles on basipodite of rt. mandible; fig. 5, lat., unknown features (possibly bases to bristles; cf. fig. 4) along margin of basipodite of lt. mandible.

Scale A (250 μm; ×67), fig. 1; scale B (100 μm; ×120), scale C (250 μm; ×47) fig. 3; scale D (25 μm; ×473), fig. 4; scale E (25 μm; ×360), fig. 5.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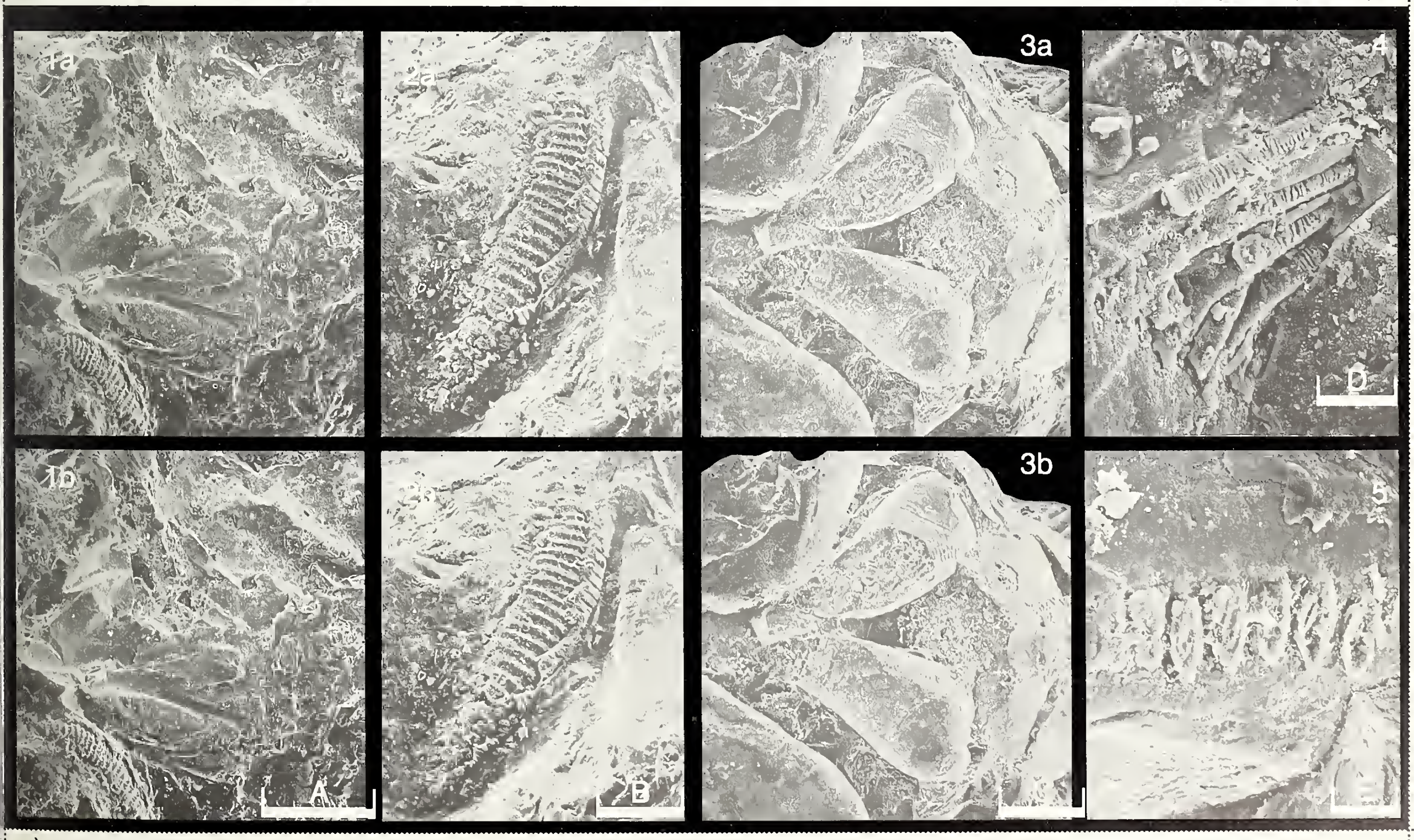
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preservation of Triassic myodocopids (Weitschat, *op. cit.*, 1983), Cretaceous podocopid ostracods (Bate, R.H., *Palaeontology*, **15**, 379–393, 1972) and numerous Cambrian arthropods (e.g. Walossek, D. & Müller, K.J., *Acta zool. (Stockh.)*, **73**(5), 305–312, 1992 and references therein).

(b) *Functional morphology:* The maxillae and 5th limbs of Recent cylindroleberidids play an essential role in creating water currents ('epipodial fan') and collecting (e.g. by maxillar setae) and directing (by spatulate-like exopodites) food to the mouth (Cannon, G., *Trans. R. Soc. Edinb.*, **57**, 739–764, 1933). Similar features in *J. jubata* suggest that it, too, was an active 'filter-feeder' (cf. Text-figs. 1D, 3). The interdigitated setae of the ventilatory fan of its 5th limb (Pl. **22**, 87, fig. 4) are identical to those of Recent cylindroleberidids. However, it is not clear whether cylindroleberidids use the abundant, ventral comb-like setae of their 4th–6th appendages (Text-fig. 3) as filters or as paddles to create feeding currents in a viscous medium (low Reynold's number; Vannier, J. & Abe, K., *J. Crust. Biol.*, **13**, 1993).

Recent cylindroleberidids, such as *Leuroleberis surugaensis* Hiruta, 1982, are chiefly infaunal 'filterers' in shallow water (< 150 m depth) and at times are also good swimmers (JV, unpubl. obs.). Some features of *J. jubata*, such as its well-developed antennal protopodite (Pl. **22**, 91, fig. 2), are probably adaptations for swimming. A row of conspicious, almond-shaped microstructures along the ventral margin of its mandibular basipodite (Pl. **22**, 89, figs. 3, 5) are possible remains of (sensory?) triaenid bristles (cf. Text-fig. 2). The backward projection of its mandibular basipodite may represent an endite, a feature found in many cylindroleberidids.

The remains of possible branchial attachment (Pl. **22**, 89, fig. 1) are inconclusive evidence for the presence of gills in *J. jubata* (Kornicker *op. cit.*, 1981). Recent cylindroleberidids of comparable size usually have 7 pairs of book gills (Vannier, J. *et al.*, *J. Crust. Biol.*, in press). The wrinkled external surface of the carapace of *J. jubata* may represent an artefact (of a poorly mineralised carapace?) rather than ornament. Similar wrinkles occur in phosphatised Triassic myodocopes (Weitschat, *op. cit.*, 1983).

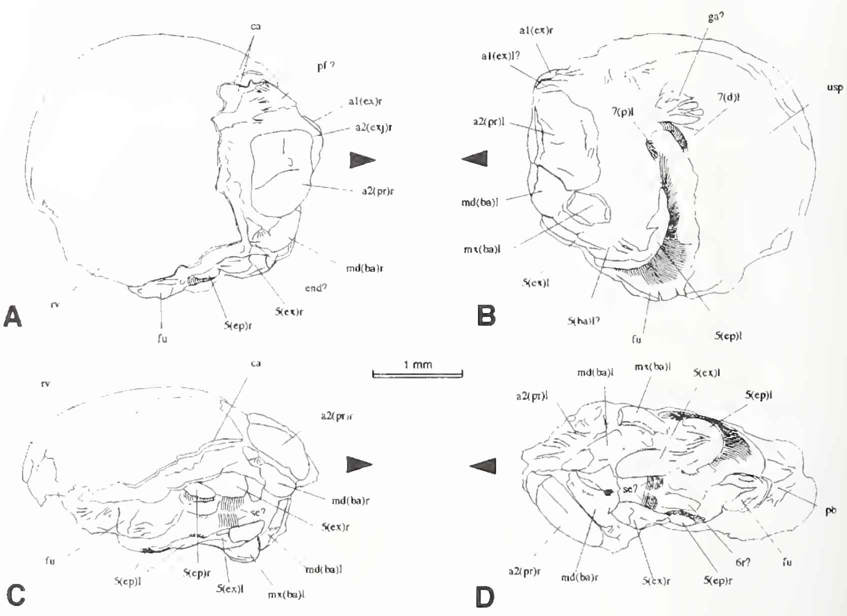
Males of cylindroleberidids commonly have a more elongate carapace and stronger 2nd antennal protopodite than females (see *L. surugaensis* in Vannier *et al.*, *J. Crust. Biol.*, in press). The holotype of *J. jubata* has a rounded shape and is possibly a female or preadult.

Distribution: Known only from the type locality.

Explanation of Plate 22, 91

Figs. 1–4, carapace, part of rt. valve removed, showing soft anatomy (holotype, **PIN 3775/1**, 3.3 mm long & 2.8 mm high): fig. 1, rt. lat.; fig. 2, rt. lat., protopodite of rt. 2nd antenna; fig. 3, rt. lat., protopodite of rt. 2nd antenna and basipodite of rt. mandible; fig. 4, vent. obl., ornament and pore opening in rt. valve.

Scale A (1000 μm; ×15), fig. 1; scale B (250 μm; ×47), fig. 2; scale C (100 μm; ×78), fig. 3; scale D (10 μm; ×1025), fig. 4.



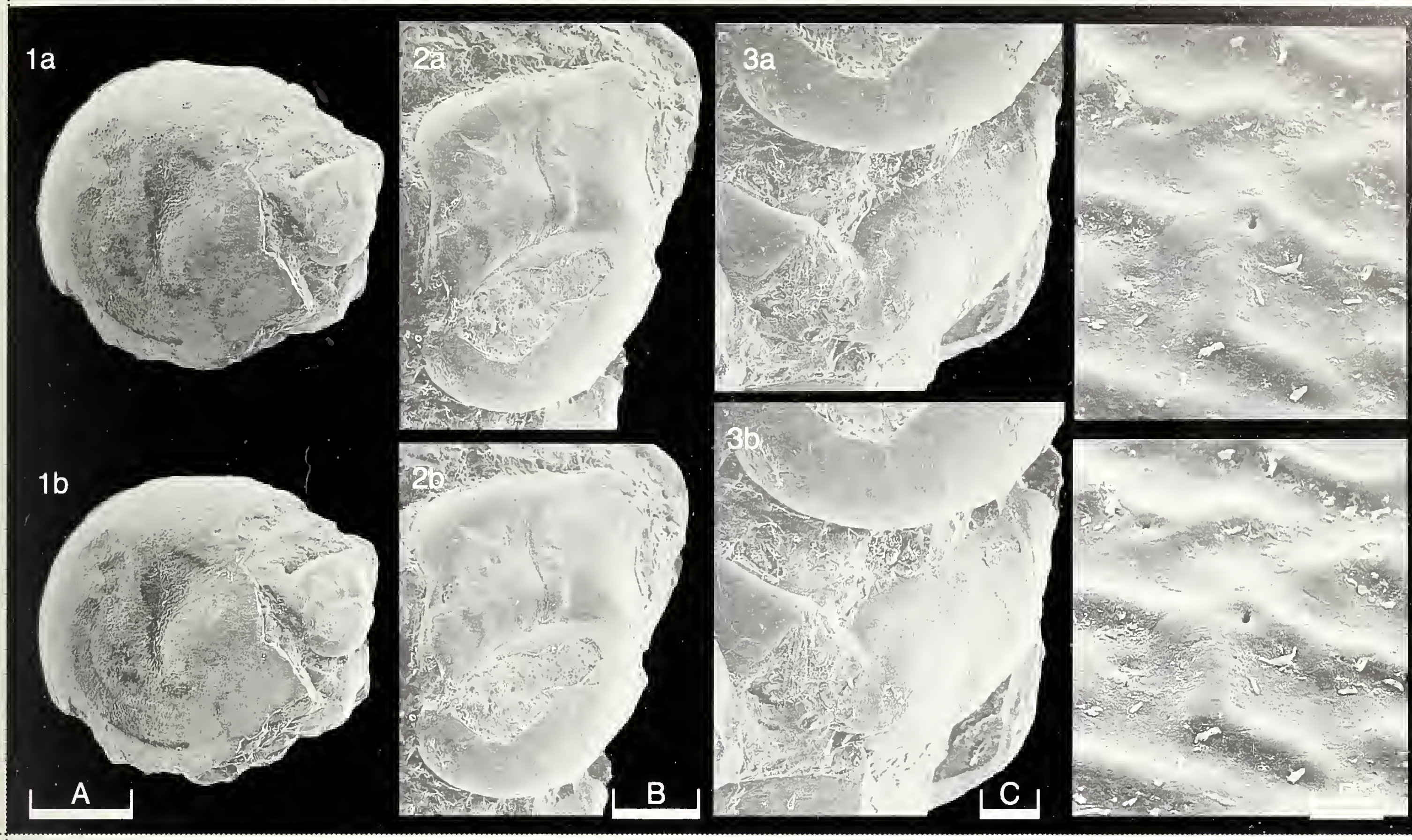
Text-fig. 1. Interpretation of soft parts, in right and left lateral (A, B), ventral oblique (C) and ventral (D) views (Pls. **22**, 87, fig. 1; Pl. **22**, 91, fig. 1; Pl. **22**, 93, figs. 1, 4).

Arrows point anteriorly. Shaded areas represent soft anatomy recognised. a1(ex)l?: expodite of left 1st antenna ?. a1(ex)r: expodite of right 1st antenna. a2(exj)r: position of joint to exopodite of right 2nd antenna. a2(pr)l: protopodite of left 2nd antenna. a2(pr)r: protopodite of right 2nd antenna. ca: carapace. end?: endite ?. fu: furca (basal parts). ga?: gill attachment ?. md(ba)l: basipodite of left mandible. md(ba)r: basipodite of right mandible. mx(ba)l: basipodite of left maxilla. pb: posterior part of body. pf?: pericardial floor?. rv: right valve. se?: possible remains of setules on exopodite of 5th limbs. usp: unidentified soft parts. 5(ba)l?: protopodite of left 5th limb? 5(ep)l: epipodite of left 5th limb. 5(ep)r: epipodite of right 5th limb. 5(ex)l: exopodite of left 5th limb. 5(ex)r: exopodite of right 5th limb. 6r?: right 6th limb? 7(d)l: distal part of left 7th limb. 7(p)l: proximal part of left 7th limb.

Explanation of Plate 22, 93

Figs. 1–6, carapace (partly removed) showing soft anatomy (holotype, **PIN 3775/1**, 3.3 mm long): fig. 1, rt. vent. obl., carapace; fig. 2, rt. vent. obl., vent. part of epipodite of rt. 5th limb showing stout bristles; fig. 3, vent., vent. part of epipodite of rt. 5th limb showing stout bristles; fig. 3, vent., vent. part of epipodite of rt. 5th limb showing stout bristles; fig. 4, vent. (ant. to the lt.); fig. 5, lt. lat. obl., epipodite of lt. 5th limb and basal part of furca; fig. 6, lt. lat., proximal part of lt. 7th limb.

Scale A (1000 μm; ×15), fig. 1; scale B (75 μm; ×132), fig. 2; scale C (75 μm; ×150), fig. 3; scale D (500 μm; ×18), fig. 4; scale E (250 μm; ×47), fig. 5; scale F (25 μm; ×300), fig. 6.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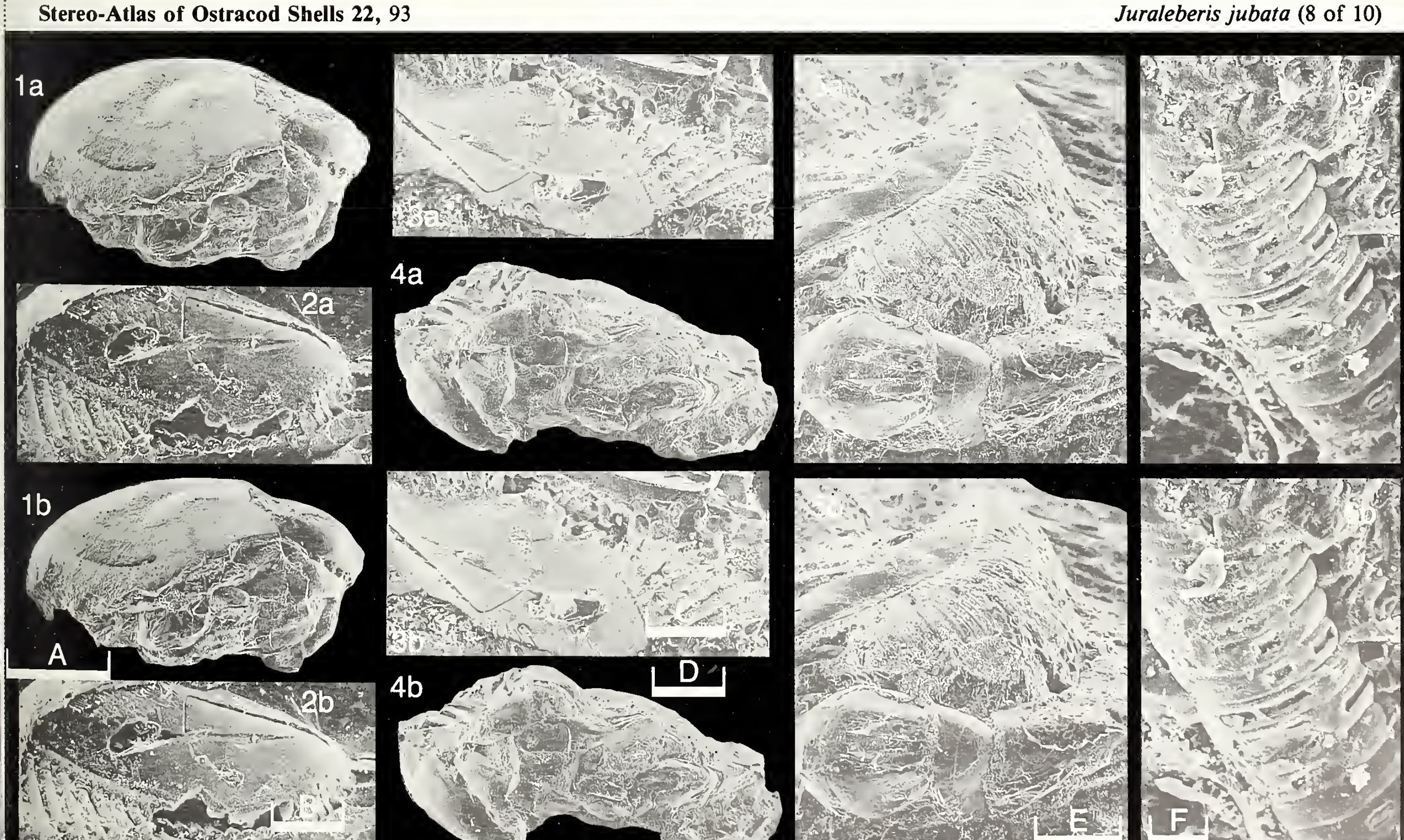
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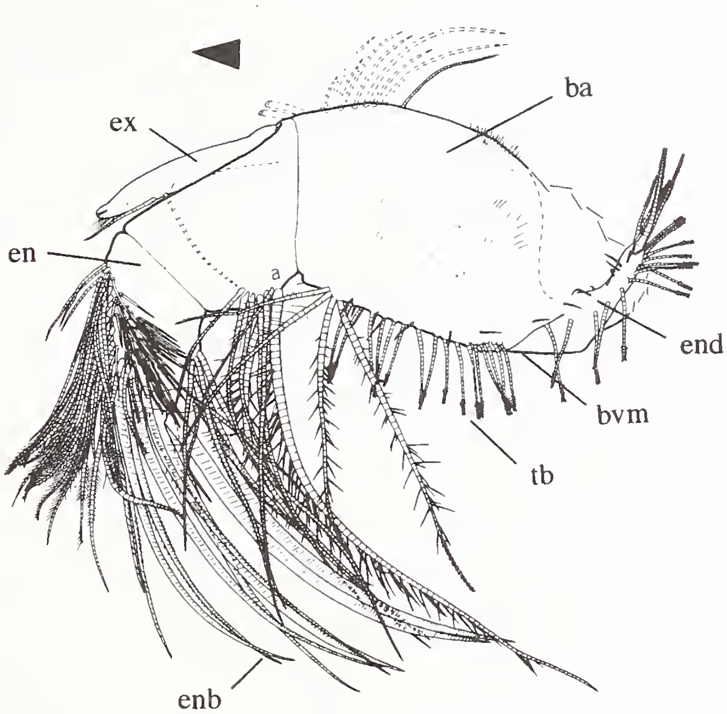
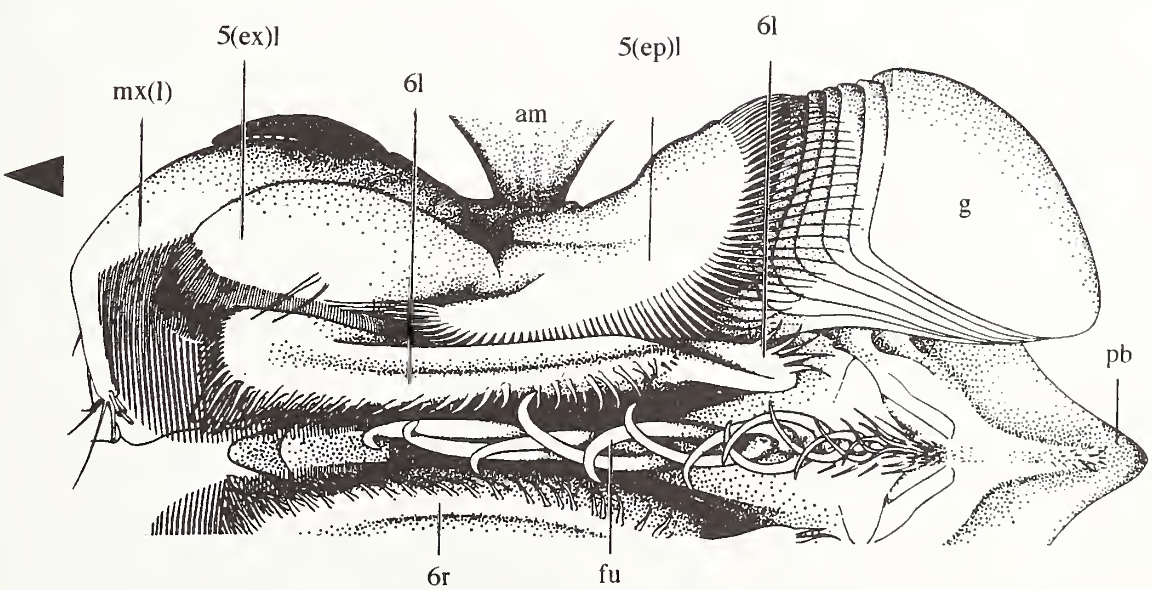


Text-fig. 2. Lateral view of mandible of the Recent cylindroleberidid *Leuroleberis sharpei* Kornicker (1981, fig. 30).
Arrow points anteriorly. ba: basipodite. bvm: basal ventral margin. en: 1st podomere of endopodite. enb: bristles of endopodite. end: endite with triaenid tip. ex: exopodite. tb: triaenid bristles.



Text-fig. 3. Reconstruction of the ventral morphology of the Recent cylindroleberidid *Cyclasterope hendersoni* Brady, 1897 (modified from Cannon 1933, fig. 6a). The maxilla and the 5th limb plays an important role by ventilating the domicilar cavity and filtering food particles.
Arrow points anteriorly. am: left adductor muscles bundle. fu: furcal lamellae. mxl: left maxilla. g: gill. pb: posterior part of body. 5(ep)l: epipodite of left 5th limb. 5(ex)l: exopodite of left 5th limb. 6l: left 6th limb. 6r: right 6th limb.

Acknowledgements: We thank the Royal Society/CNRS and NATO for their support, L. Melnikova (Moscow) for loan of the material, J. Dzik (Warsaw) for correspondence and L. Kornicker (Washington) and M-C. Guillaume (Paris) for information on Recent cylindroleberidids.

595.336.14 (113.333) (766 : 162.097.34 + 768 : 162.089.35): 551.351 + 552.52

ON *KIRKBYRHIZA PRIMAEVA* (ROTH)

by Gerhard Becker & Robert F. Lundin
(Senckenberg Museum, Frankfurt-am-Main, Germany & Arizona State University, Tempe, U.S.A.)

Genus *KIRKBYRHIZA* gen. nov.
Type-species: *Amphissites primaevus* Roth, 1929

Derivation of name: From Greek *rhiza*, root; alluding to the root-stock of the kirkbyaceans. Gender, feminine.

Diagnosis: Kirkbyacean ostracod with broad and diffuse lateral lobes; posterior lobe more conspicuous than anterior lobe. Vertical (sulcal) depression rather distinct (Upper Silurian type-species) to obsolete (additional, early Devonian species), terminating ventrally in well developed adductorial pit; corresponding adductorial boss on the interior surface prominent, but interior reflection of sulcal depression dorsal to the adductorial boss weak or even absent. Dorsal surface epicline. Primarginal (outer) carina poorly developed ventrally, distinct anteriorly and posteriorly; extending onto dorsal surface at both cardinal corners, very weak on anterodorsal surface. Very fine marginal ridge on left valve. Right valve with distinct contact groove, slightly larger than left; below cardinal angles, contact slightly discontinuous; hinge structure straight and with weak cardinal projections (terminal teeth) on left valve and weak cardinal depressions (terminal sockets) on right valve.

Remarks: *Kirkbyrhiza* is a typical kirkbyacean, as shown by its carapace shape, the presence of admarginal structures and the subcentral position of the adductor muscle field which apparently is an apomorphic character.

Kirkbyrhiza primaeva (Roth, 1929) is the oldest known kirkbyacean species and near the origin of this group. The sulcal depression, terminating ventrally in the adductorial pit (only conspicuous in the type-species), is considered to be an ancestral character (S2) inherited from its presumed (hypothetical) drepanellid ancestors. The ambivalent affinity of the new genus to both the Amphissitidae Knight, 1928 (with lobes and subcentral node) and the Arcyzonidae Kesling, 1961 (without the subcentral node), shown also by the early Devonian *Eoarcyzona* Becker & Wang (*Palaeontographica*, A **124**, 18, 1992), confirms the close

Explanation of Plate 22, 97

Fig. 1 adult car., rt. ext. lat. (**X-248**, 1390 μm long). Fig. 2, adult LV, int. lat., detail showing anterior cardinal tooth (arrow) (**X-249**, 1505 μm long). Fig. 3, adult LV, ext. lat. (**X-257**, 1365 μm long).
Scale A (300 μm; ×59), fig. 1; scale B (100 μm; ×205), fig. 2; scale C (300 μm; ×60), fig. 3.

relationship between the Amphissitidae and the Arcyzonidae. Because of its rather simple carapace morphology, *Kirkbyrhiza* is placed in the Arcyzonidae.

Distribution: Presently known from the type-species, which occurs in the Upper Silurian (Ludlow and Přídolí series) of western Tennessee and south-central Oklahoma, and by an additional species, *Amphissites retiferus* Roth, 1929, from the Lower Devonian (Lochkovian) of the same areas.

Kirkbyrhiza is probably endemic to the North American midcontinent area.

Kirkbyrhiza primaeva (Roth, 1929)

1929 *Amphissites primaevus* sp. nov. R. Roth, *J. Paleont.*, **3**, 346, pl. 36, fig. 10a.
1961 *Reticestus? primaevus* (Roth); I.G. Sohn, *Prof. Pap. U.S. geol. Surv.*, **330-B**, 140, pl. 11, figs. 29-32.
1965 *Amphissella primaeva* (Roth); R.F. Lundin, *Bull. Okla geol. Surv.*, **108**, 39, pl. 6, figs. 1a–j.

Holotype: United States National Museum of Natural History, Washington (**USNM**) no. **80658H**; juvenile right valve. This specimen was illustrated by Lundin (1965) but not by Roth (1929), who illustrated only a paratype (**USNM 80658A**), a juvenile left valve.

Type locality: The locality data given by Roth (1929) strongly suggests that the holotype is from Upper Silurian (late Ludlow-Přídolí) strata of the Henryhouse Fm. The species is certainly present in that unit at Lundin's (1965, *op. cit.*) section P3; approximate lat. 34° 35′ N, long. 96° 50′ W (see also T.W. Amsden, *Bull. Okla geol. Surv.*, **84**, panel 2, 1960).

Figured specimens: Department of Geology, Arizona State University (**ASU**), nos. **X-248** (car.: Pl. **22**, 97, fig. 1), **X-249** (LV: Pl. **22**, 97, fig. 2), **X-250** (LV: Pl. **22**, 99, fig. 1, Pl. **22**, 103, fig. 2), **X-251** (RV: Pl. **22**, 99, figs. 2, 3), **X-252** (car.: Pl. **22**, 101, figs. 1, 4), **X-253** (LV: Pl. **22**, 103, fig. 1), **X-254** (RV: Pl. **22**, 103, fig. 4), **X-255** (RV: Pl. **22**, 103, fig. 3), **X-256** (RV: Pl. **22**, 103, fig. 5) and **X-257** (LV: Pl. **22**, 97, fig. 3). **USNM 80658H** (holotype, juv. RV: Pl. **22**, 101, fig. 2), **USNM 80658A** (paratype, juv. LV: Pl. 101, fig. 3).

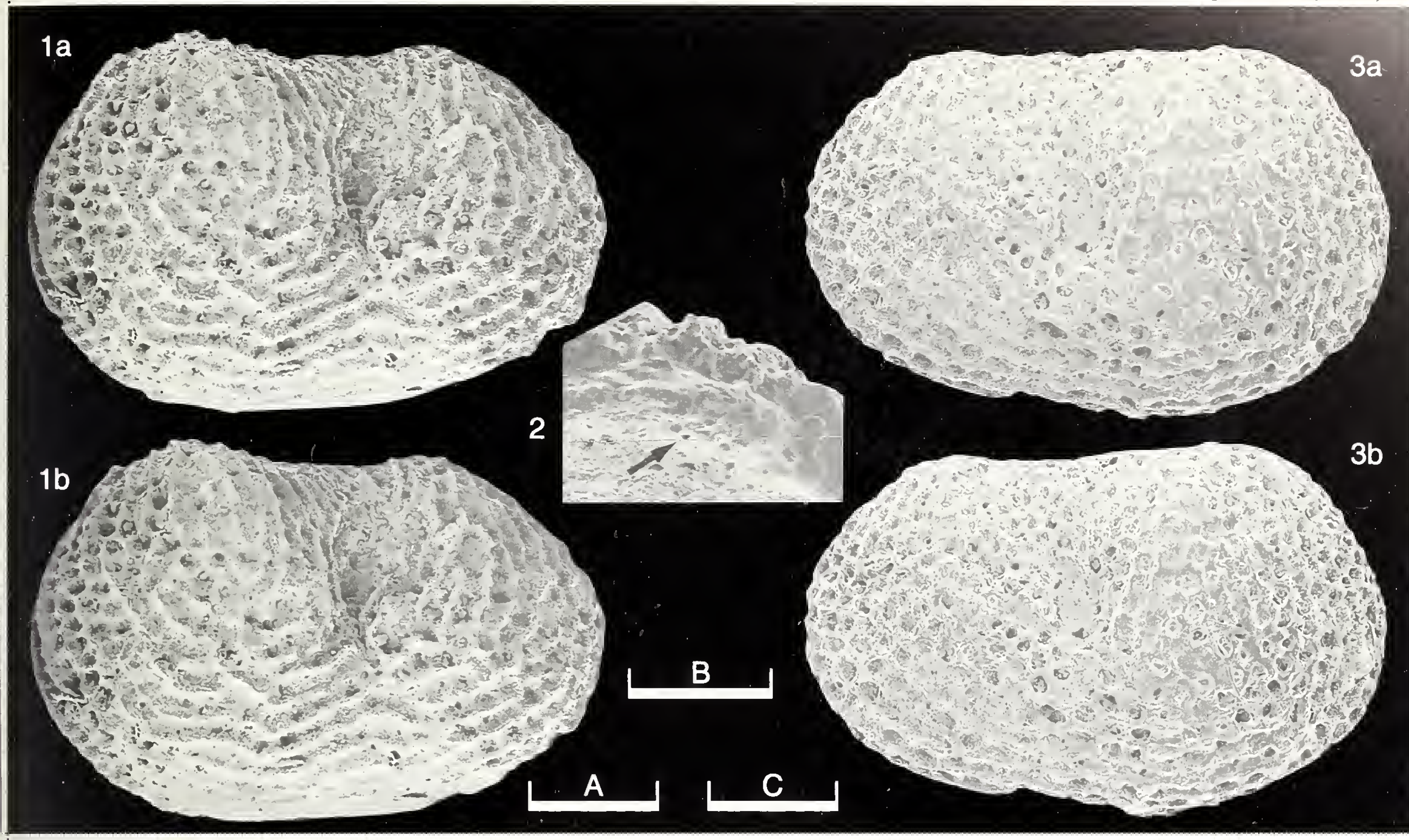
ASU X-248 and **X-250** to **X-257** are from Lundin's (1965) sample P5–9, 15.1 m above the base of the Brownsport Fm at section P5, a glade 9.2 km SE of Decaturville, Peryville Quadrangle, Decatur County, Tennessee, U.S.A.; lat. 35° 30′ 49.5″ N, long. 88° 3′ 24″ W. **ASU X-249** is from the middle part of the Brownsport Fm (sample 06–8) at section 06, a roadcut along U.S. Highway 64, approximately 3.7 km SW of Olivehill, Olivehill Quadrangle, Hardin County, Tennessee, U.S.A.; lat. 35° 15′ 29.5″ N, long. 88° 4′ 6″ W. **USNM 80658H** and **80658A** are from the type locality. All figured specimens are of Ludlow or Přídolí, Upper Silurian age.

Diagnosis: *Kirkbyrhiza* species with a comparatively conspicuous sulcal depression and slightly irregular reticulation pattern.

Remarks: The reticulation pattern approximately parallels the free margin. On the lateral surface of the lobes near the sulcal depression,

Explanation of Plate 22, 99

Fig. 1, adult LV, int. lat. (**X-250**, 1350 μm long). Figs. 2, 3, adult RV (**X-251**, 1355 μm long): fig. 2, int. lat., detail showing anterior cardinal depression (arrow); fig. 3, int. lat.
Scale A (300 μm; ×66), fig. 1; scale B (100 μm; ×102), fig. 2; scale C (300 μm; ×62), fig. 3.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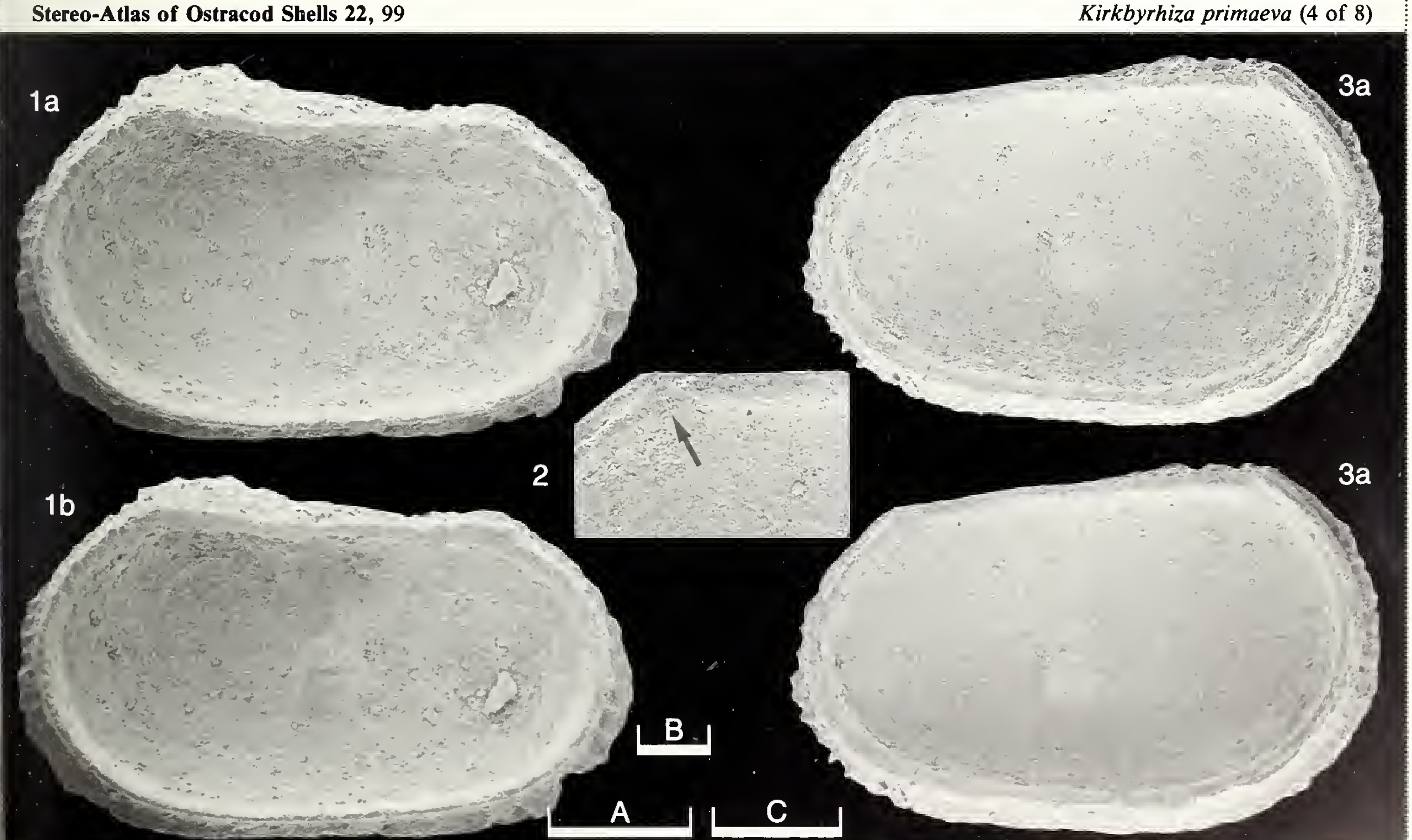
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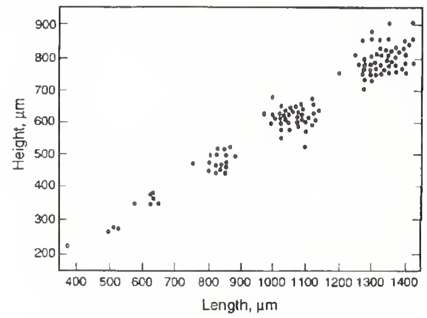
the reticula are arranged in dorsoventral rows. This reticulation pattern distinguishes this species from the closely related Lower Devonian species, *Kirkbyrhiza retifera* (Roth, 1929), in which the reticula form a concentric pattern around the adductorial pit. Moreover, the sulcal depression is practically obsolete in the younger species. Probably, the anterior cardinal depression/projection is more conspicuous than the posterior one (see Pl. **22**, 99).

Distribution: This species is known from Upper Silurian (Ludlow–Přídolí) strata of south-central Oklahoma (Henryhouse Fm) and western Tennessee (Brownsport Fm) (see text-figs. 2, 3). Lundin (*Bull. Okla geol. Surv.*, **116**, 1968) has shown that this species does not occur in the Haragan Formation, as stated by Roth (1929), and Petersen & Lundin (*in* Chaplin, J.R. & Barrick, J.E., *Bull. Okla geol. Surv.*, **145** 1992) have shown that this species does not occur in Lower Devonian strata of western Tennessee, as indicated by Wilson (*J. Paleont.*, **9**, 638, 1935). Wilson's report certainly refers to the closely related *Kirkbyrhiza retifera*. The non-lobate *Reticestus planus* (Wilson, 1935), reported from the Lower Devonian of western Tennessee (Peterson & Lundin, 1992) is a separate, valid species.

Kirkbyrhiza species are considered to be neritic, and characteristic of shallow-water environments below the wave base.

Acknowledgements: The authors thank Mr. Harry Birkmann (Arizona State University) for technical assistance.

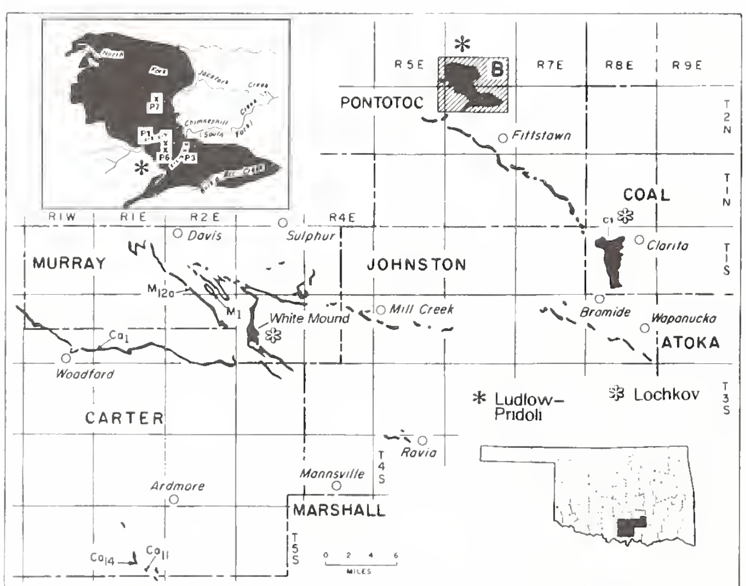


Text-fig. 1. Size dispersion of a population of *Kirkbyrhiza primaeva* from sample P5–9; late Silurian Brownsport Fm, Tennessee.

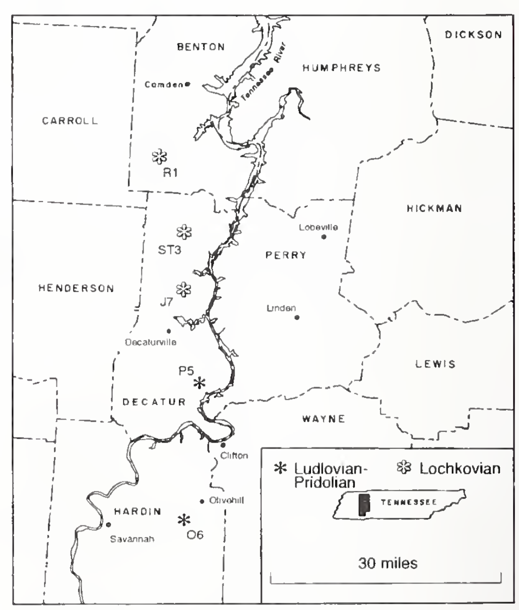
Explanation of Plate 22, 101

Figs. 1, 4, adult car. (**X-252**, 1450 µm long): fig. 1, dors.; fig. 4, vent. Fig. 2, juv. RV (holotype, **USNM 80658H**, 865 µm long). Fig. 3, juv. LV (paratype, **USNM 80658A**, 808 µm long).

Scale A (300 µm; ×63), figs. 1, 4; scale B (200 µm; ×56), fig. 2; scale C (200 µm; ×60), fig. 3.



Text-fig. 2. Map of Arbuckle Mountains (with Pontotoc county detail), Oklahoma, showing upper Silurian/early Devonian outcrops (black) and ostracod localities (stars); Ludlow–Přídolí = Henryhouse Fm with *K. primaeva*, Lochkov = Haragan Fm with *K. retifera*. After Lundin (1965, 1968).

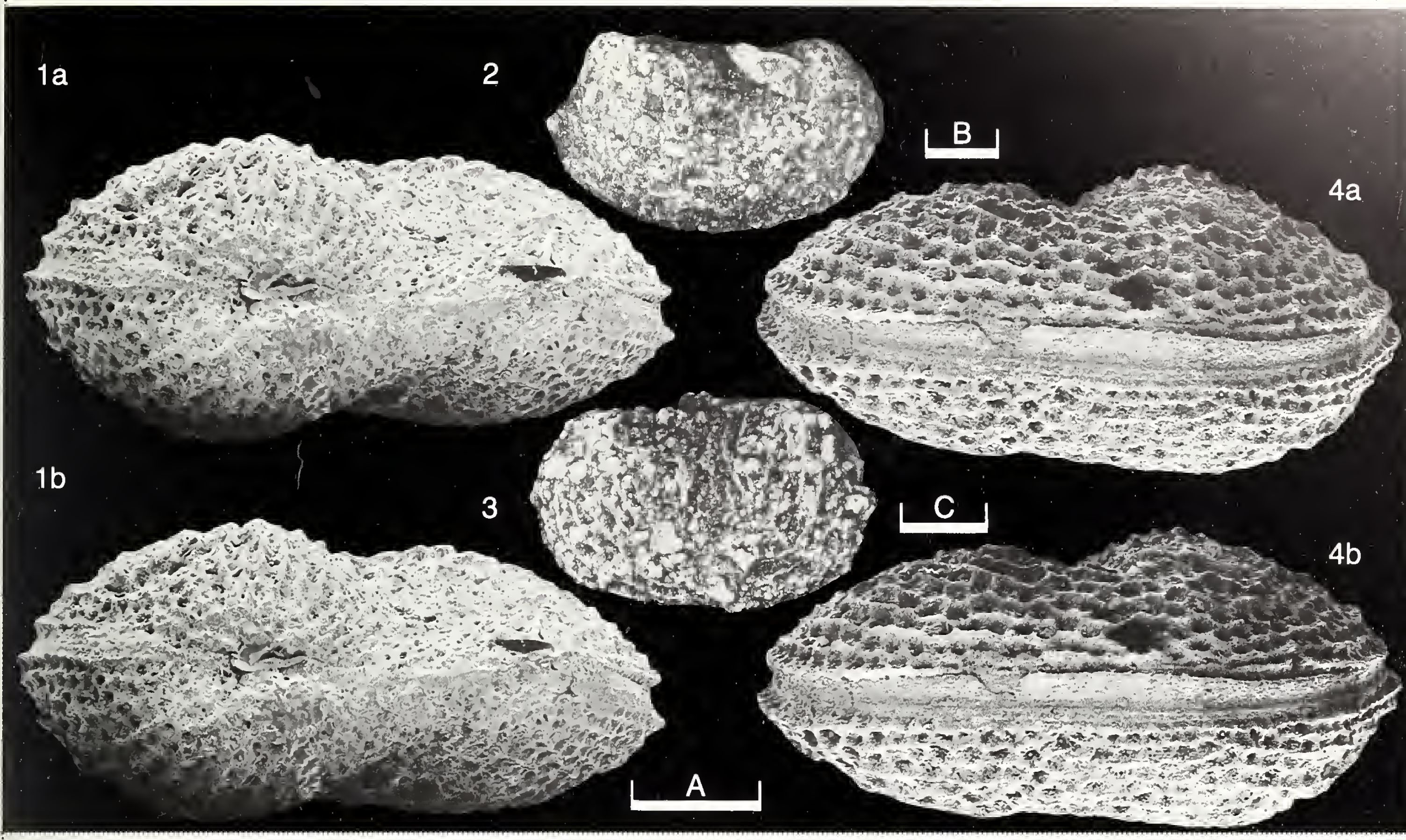


Text-fig. 3. Ostracod localities in the Tennessee valley; Ludlow = Brownsport Fm with *K. primaeva*, Lochkov = Birdsong Fm with *K. retifera*. After Petersen & Lundin (1992).

Explanation of Plate 22, 103

Fig. 1, adult LV, vent. (**X-253**, 1420 µm long). Fig. 2, adult LV dors. (**X-250**, 1350 µm long). Fig. 3, adult RV, post. (**X-255**, 1365 µm long). Fig. 4, adult RV, dors. (**X-254** 1380 µm long). Fig. 5, adult RV, ant. (**X-256**, 1335 µm long).

Scale A (300 µm; ×64), figs. 1, 4; scale B (300 µm; ×54), fig. 2; scale C (300 µm; ×62), fig. 3; scale D (300 µm; ×65), fig. 5.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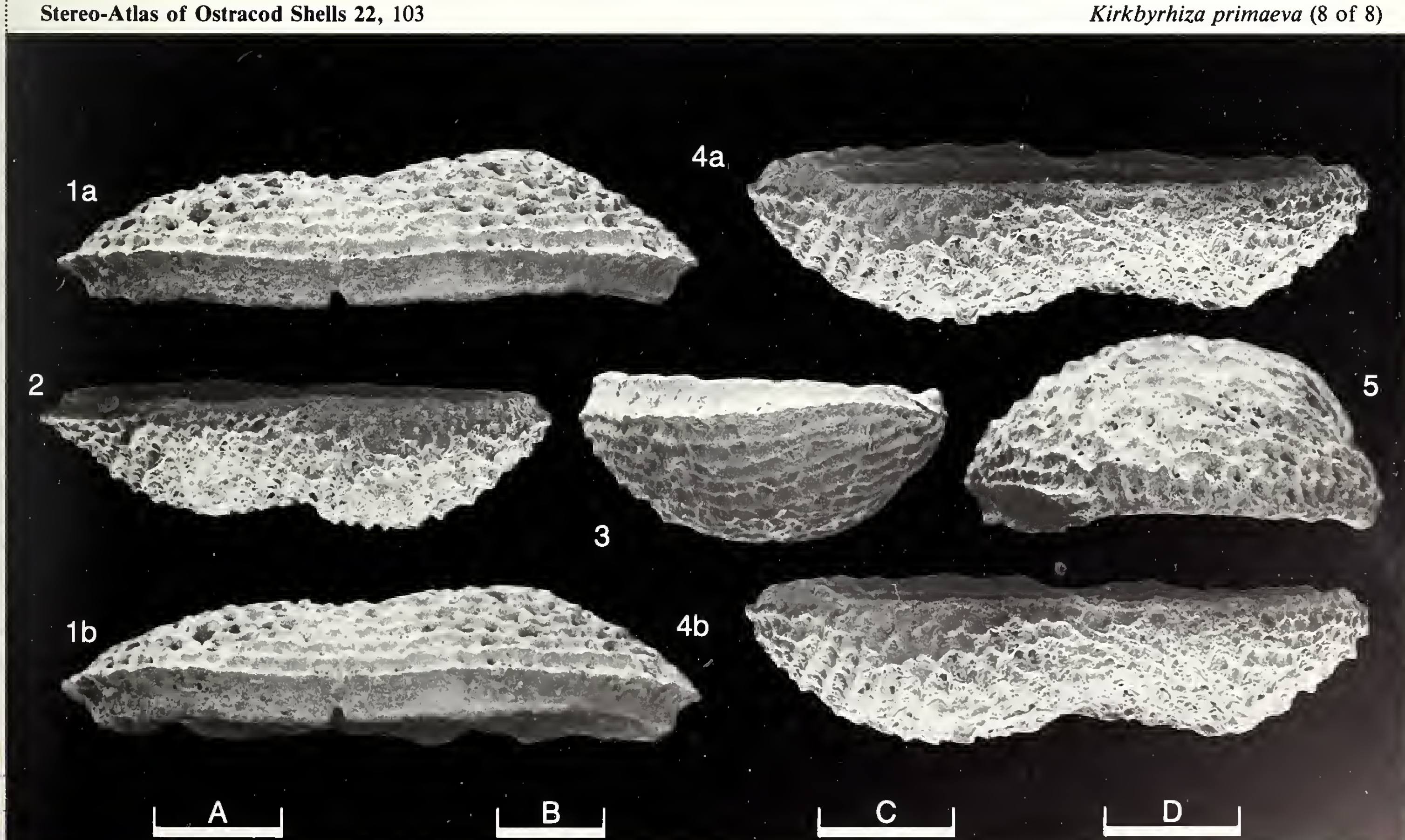
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ON *POLYCOPE MOENIA* JOY & CLARK

by Richard Jones & Robin C. Whatley
(Institute of Earth Studies, University of Wales, Aberystwyth, U.K.)

Polycope moenia Joy & Clark, 1977

1977 *Polycope? moenia* n. sp., J.A. Joy & D.L. Clark, *Micropaleontology*, **23**, 145, Pl. 3, figs. 17–19.

Type specimens: Department of Geology and Geophysics, University of Wisconsin, Madison (UW): Holotype, **UW 1597-17b**, Paratypes **UW 1597-17a** and **UW 1597-17c**.

Type locality: Core FL 290, 20–1, central Arctic Ocean (lat. 84° 23.40′ N, long. 143° 51.19′ W). Water depth 2262m; Recent.

Figured specimens: The Natural History Museum, London [BMNH] nos. **1996.90** (adult RV: Pl. **22**, 105, fig. 1; Pl. **22**, 107, fig. 3), **1996.91** (adult LV: Pl. **22**, 105, figs. 2, 3), **1996.92** (adult RV: Pl. 2, figs. 1, 2).

All specimens collected from the Morris Jesup Rise, Arctic Ocean (lat. 85° 19.4′ N, long. 14° W) on the ARK VIII/3 (ARCTIC '91) cruise; Recent.

Diagnosis: Carapace sub-circular with an irregular margin, widest at mid-height. Anterior margin nearly straight, fringed by a series of short spines; two prominent antero-dorsal spines make up part of a slightly arched dorsal margin. Ventral margin irregular due to a number of small anteroventral denticles which merge into a posteroventral keel, that ends at mid-height in the right valve only. Valve surface strongly reticulate with muri orientated in rows parallel to the periphery near the dorsal margin, becoming lower and less organised towards the ventral surface. Second order reticulation is weak and discontinuous across the

Explanation of Plate 22, 105

Fig. 1, adult RV, ext. lat. (**1996.90**, 315 μm long). Figs. 2, 3, adult LV (**1996.91**, 310 μm long): fig. 2, ext. lat.; fig. 3, post. vent. ornament.
Scale A (100 μm; ×160), figs. 1, 3; scale B (50 μm; ×320), fig. 2.

whole valve. Antero-dorsally, the flange is enhanced by the presence of minute transverse ridges. Carapace articulated by a simple adont hinge; three sub-equal muscle scars occur ventro-centrally.

Remarks: *Polycope moenia* is one of a large group of polycopids that occur at high latitudes in the Arctic Ocean. It is easily distinguished from its co-habitants in the Arctic basins, but is morphologically similar to other species in the Greenland/Norway Seas and the North Atlantic Ocean. The main reason for confusion between these species is that they all display high degrees of reticulation. However, it is subtle variations within the ornamentation of the valves that allows the separation of the species.

Polycope areolata and *Polycope clathrata*, both Sars, 1923 (*An Account of the Crustacea of Norway*, **9**, 33–34), possess coarser and finer densities of reticulation respectively compared with *P. moenia. P. areolata* is sculptured by wide polygonal meshes whereas *P. clathrata* has a surface of very dense and crowded muri. Neither exhibits any form of secondary reticulation and both lack prominent antero-dorsal spines.

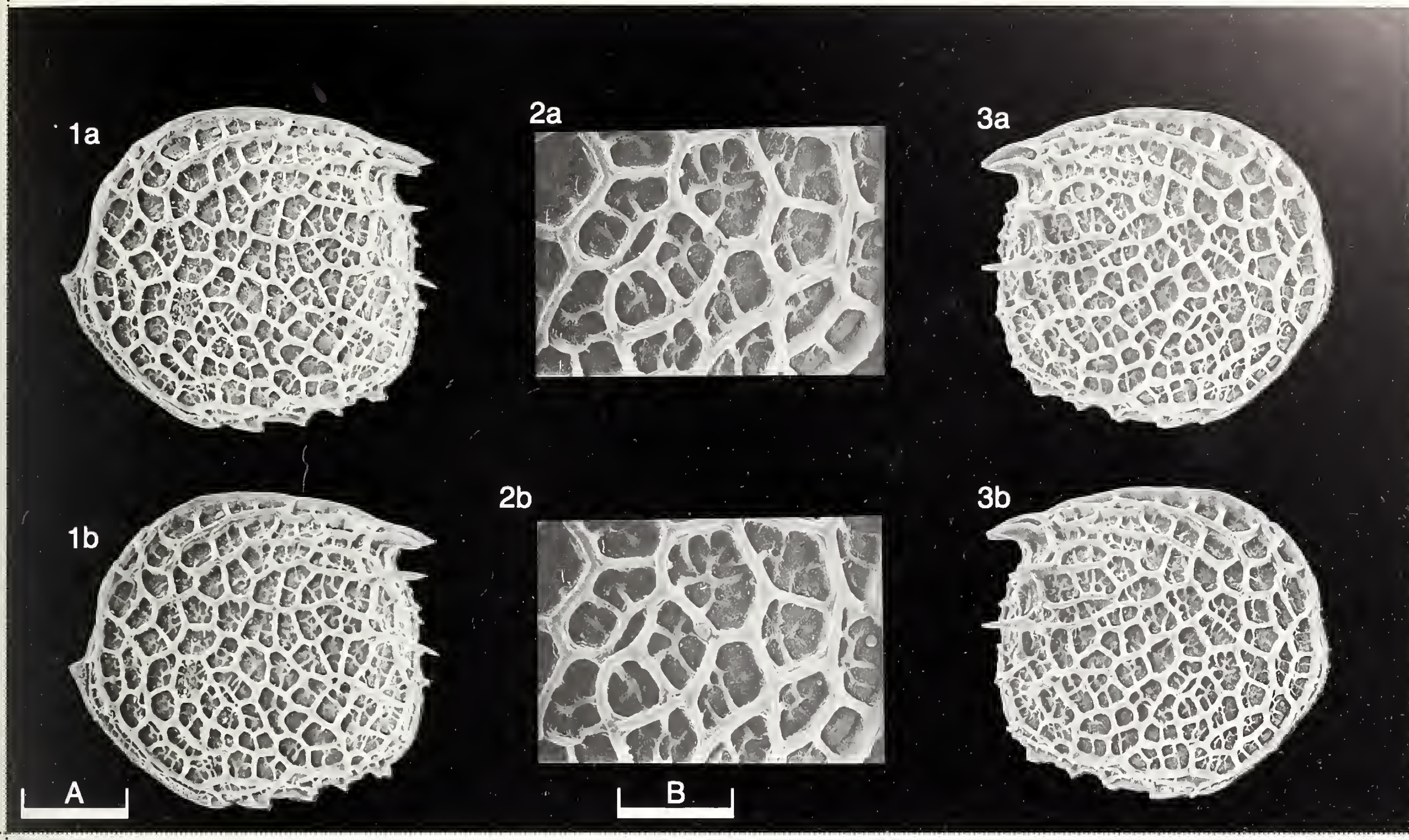
Joy and Clark (*op. cit.*) did not consider *P. moenia* to be a typical *Polycope* species because of its irregular outline, obscured hinge and muscle scars. Further investigation has revealed the presence of an adont hinge and an arrangement of three muscle scars (Pl. 22, 107, figs. 1 and 2). This allows us to assign *P. moenia* to the genus *Polycope* with greater confidence.

Distribution: *Polycope moenia*, like the other Arctic polycopids, can be significant numerically, but its ecological significance is still poorly understood. This is mainly due to its very patchy distribution both geographically and stratigraphically. Although essentially benthonic, *Polycope* is known to be a rapid swimmer characterising highly oxygenated waters usually at 1000–1500 m depth, where the North Atlantic water mass flows through the Fram Strait into the Eurasian Basin. The genus is always found in fine grained, organically rich sediments. The ecological and morphological evidence available suggests that *Polycope* is able to migrate in or out of nutrient-rich areas relatively quickly.

P. moenia is present in the two major basins (Canadian and Eurasian) of the Arctic Ocean and in the Greenland Sea. It characterises interglacial-age (warm) sediments.

Explanation of Plate 22, 107

Fig. 1, 2, adult RV (**1996.92**, 315 μm long): fig. 1, hinge; fig. 2, int. lat. Fig. 3, adult RV (**1996.90**), anterodorsal spine.
Scale A (50 μm; ×240), fig. 1; scale B (100 μm; ×160), fig. 2; scale C (20 μm; ×500), fig. 3.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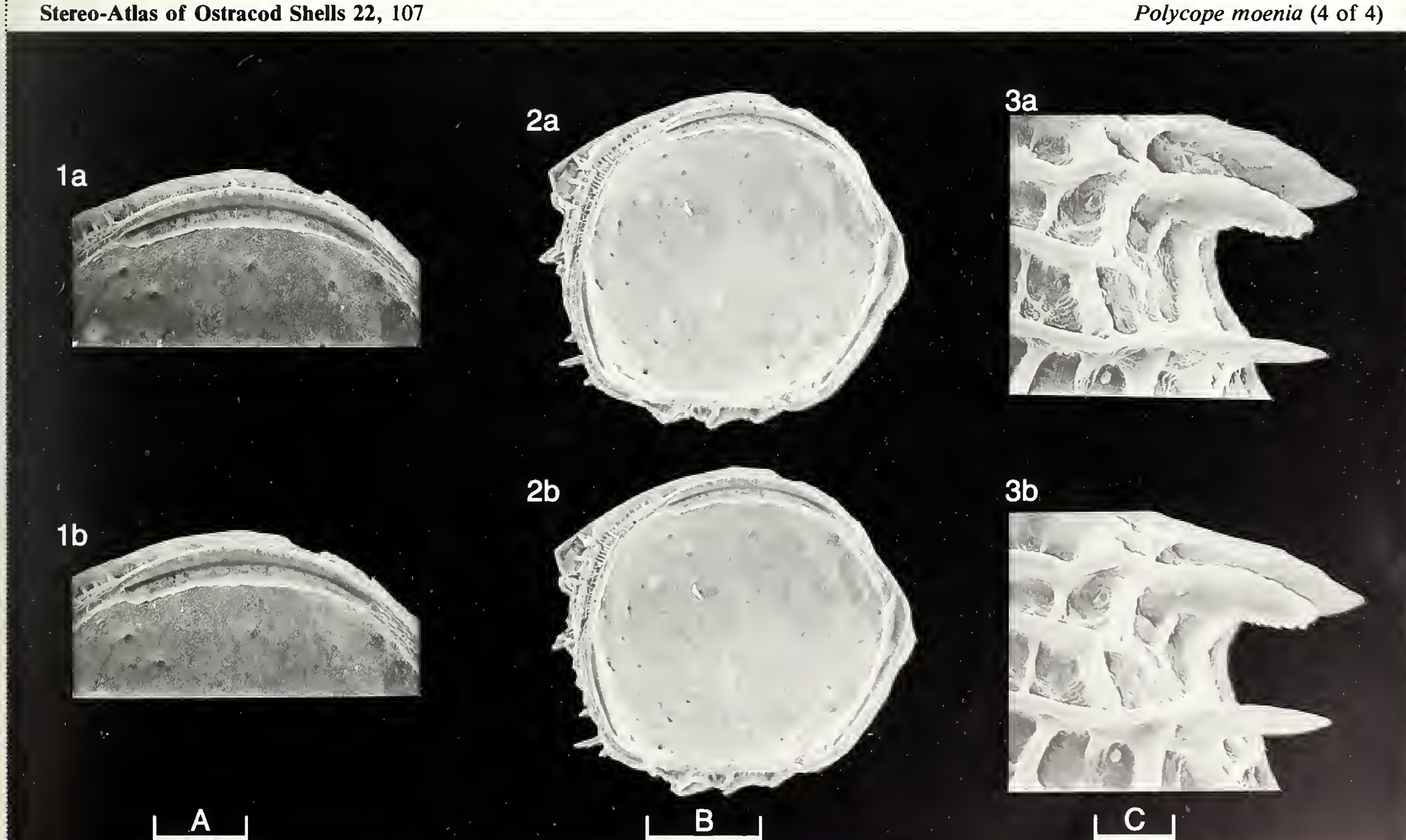
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Stereo-Atlas of Ostracod Shells 22 (24) 108–111 **(1995)**
595.337.14 (118.15) (265 : 162.180.18): 551.352 + 552.54

ON *CYTHEROPTERON NUDUM* BOOMER sp. nov.

by Ian Boomer
(School of Environmental Sciences, University of East Anglia, Norwich, England)

Cytheropteron nudum sp. nov.

1995 *Cytheropteron* sp. 2, I. Boomer & R. Whatley, *Proc. Ocean Drill. Prog. (Sci. Res.)*, **143**, pl. 3, fig. 13–14.

Holotype: The Natural History Museum, London [BMNH] no. **OS 14852**; adult RV. [Paratype: no. **OS 14853**].

Type locality: Allison Guyot, Central Pacific Ocean (lat. 18° 26.41′ N, long. 179° 33.33′ W), Ocean Drilling Program, Leg 143, Site 865B, Core 2, core-catcher (0–8 cm); Lower Oligocene.

Derivation of name: With reference to the absence of any external ornament.

Figured specimens: The Natural History Museum, London [BMNH] nos. **OS 14852** (holotype, RV: Pl. **22**, 109, figs. 1, 2, Pl. **22**, 111, fig. 2), **OS 14853** (paratype, LV: Pl. **22**, 109, fig. 3; Pl. **22**, 111, figs. 1, 3).

Diagnosis: A large, distinctly alate species of *Cytheropteron* lacking any evidence of external ornament. The distal part of the alar process terminates in a stout tubular process while the antero-ventral alar margin bears a small flange (Pl. **22**, 111, figs. 2, 3). The carapace is sub-rhomboidal in lateral view with an arched dorsal margin, particularly marked in the larger right valve. A stout, upturned caudal process is present at the postero-dorsal extremity. The hinge elements are smooth and quite delicate. The marginal zone is broad and fused throughout.

Explanation of Plate 22, 109

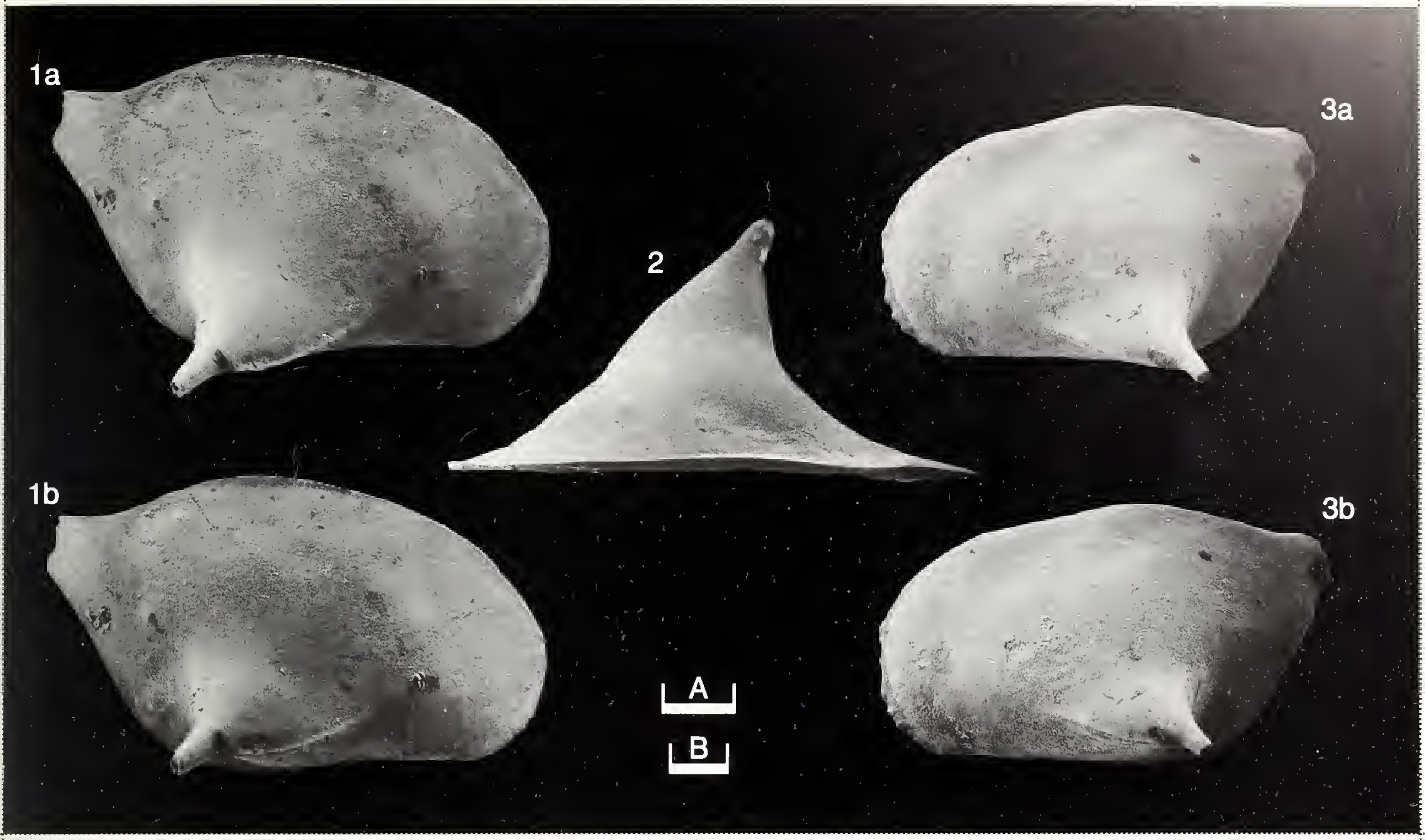
Fig. 1, 2, adult RV (holotype, **OS 14852**, 770 μm long): fig. 1, ext. lat.; fig. 2, dors. Fig. 3, adult LV, ext. lat. (paratype, **OS 14853**, 720 μm long).
Scale A (100 μm; ×92), figs. 1, 2; scale B (100 μm; ×86), fig. 3.

Remarks: The genus is common in Cainozoic deep sea assemblages, indeed, the present taxon was one of eleven *Cytheropteron* species recorded in the Upper Palaeocene to Lower Oligocene interval of ODP Site 865B (Boomer, I. & Whatley, R., *op. cit.*). Although many species of *Cytheropteron* possess well developed patterns of ornament on the lateral and ventral surfaces, *Cytheropteron nudum* lacks any such markings and is best distinguished by its size, lateral outline and alar development.

Distribution: Known only from the Upper Palaeocene to Lower Oligocene of ODP Site 865B, Mid-Pacific Mountains.

Explanation of Plate 22, 111

Fig. 1, 3, adult LV (paratype, **OS 14853**, 720 μm long): fig. 1, dors.; fig. 3, vent. Figs 2, adult RV, oblique int. vent. (holotype, **OS 14852**, 770 μm long).
Scale A (100 μm; ×92), figs. 1, 3; scale B (100 μm; ×82), fig. 2.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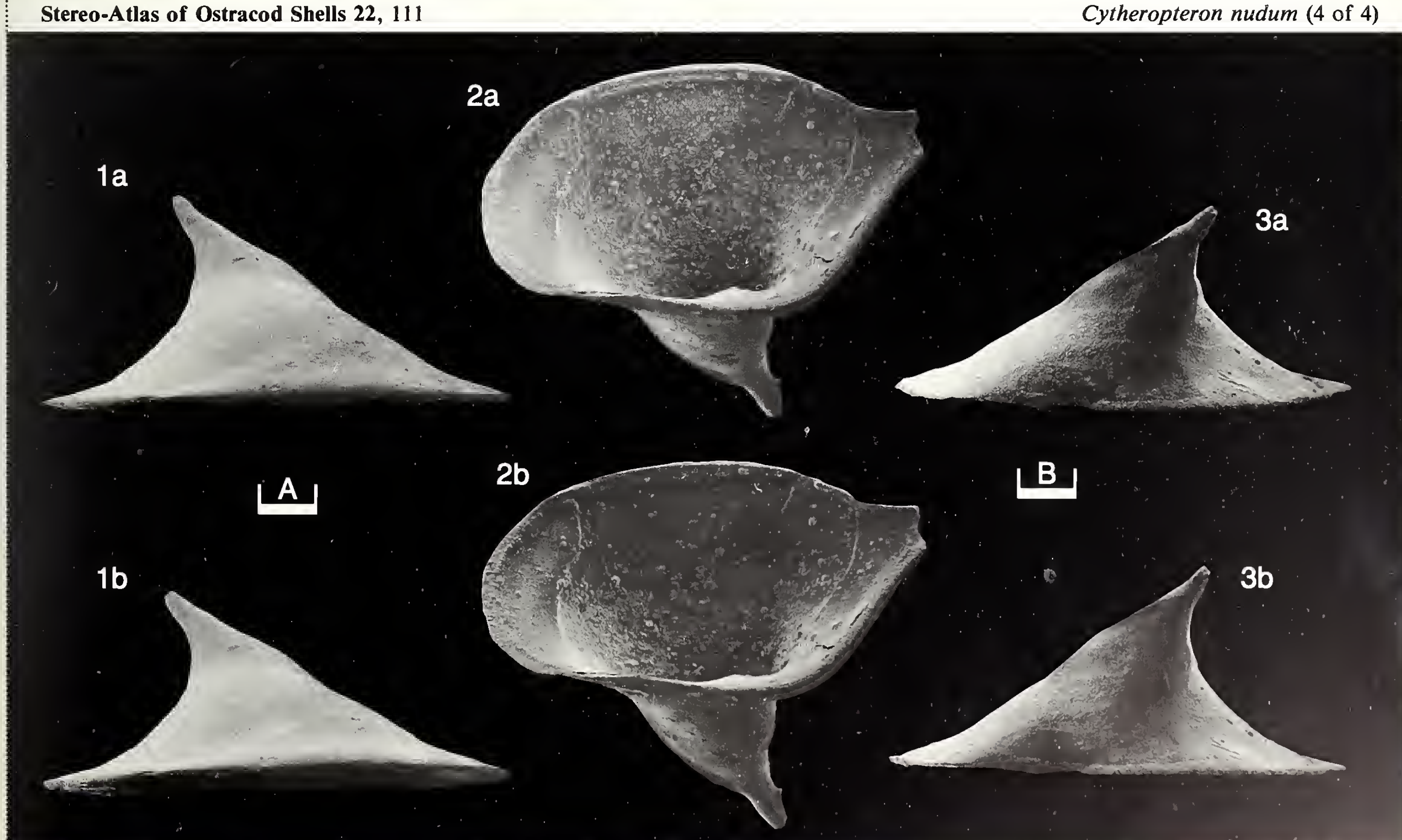
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Stereo-Atlas of Ostracod Shells 22 (25) 112–115 **(1995)**
595.337.14 (118.15) (265 : 162.180.18): 551.352 + 552.54

ON *EUCYTHERURA ALLISONENSIS* BOOMER sp. nov.

by Ian Boomer
(School of Environmental Sciences, University of East Anglia, Norwich, England)

Eucytherura allisonensis sp. nov.

1995 *Eucytherura* sp. 7, I. Boomer & R. Whatley, *Proc. Ocean Drill. Prog. (Sci. Res.)*, **143**, pl. 4, fig. 27–28.

Holotype: The Natural History Museum, London [BMNH] no. **OS 14854**; adult RV. [Paratype: no. **OS 14855**].

Type locality: Allison Guyot, Central Pacific Ocean (lat. 18° 26.41′ N, long. 179° 33.33′ W), Ocean Drilling Program, Leg 143, Site 865B, Core 2, core-catcher (0–8 cm); Lower Oligocene.

Derivation of name: With reference to the type locality Allison Guyot, Central Pacific Ocean.

Figured specimens: The Natural History Museum, London [BMNH] nos. **OS 14854** (holotype, RV: Pl. **22**, 113, fig. 1, Pl. **22**, 115, figs. 1–3), **OS 14855** (paratype, LV: Pl. **22**, 113, figs. 2, 3).

Explanation of Plate 22, 113

Fig. 1, adult RV, ext. lat. (holotype, **OS 14854**, 310 μm long). Figs. 2, 3, adult LV (paratype, **OS 14855**, 315 μm long): fig. 2. dors.; fig. 3, ext. lat.
Scale A (50 μm; ×205), figs. 1; scale B (50 μm; ×220), figs. 2, 3.

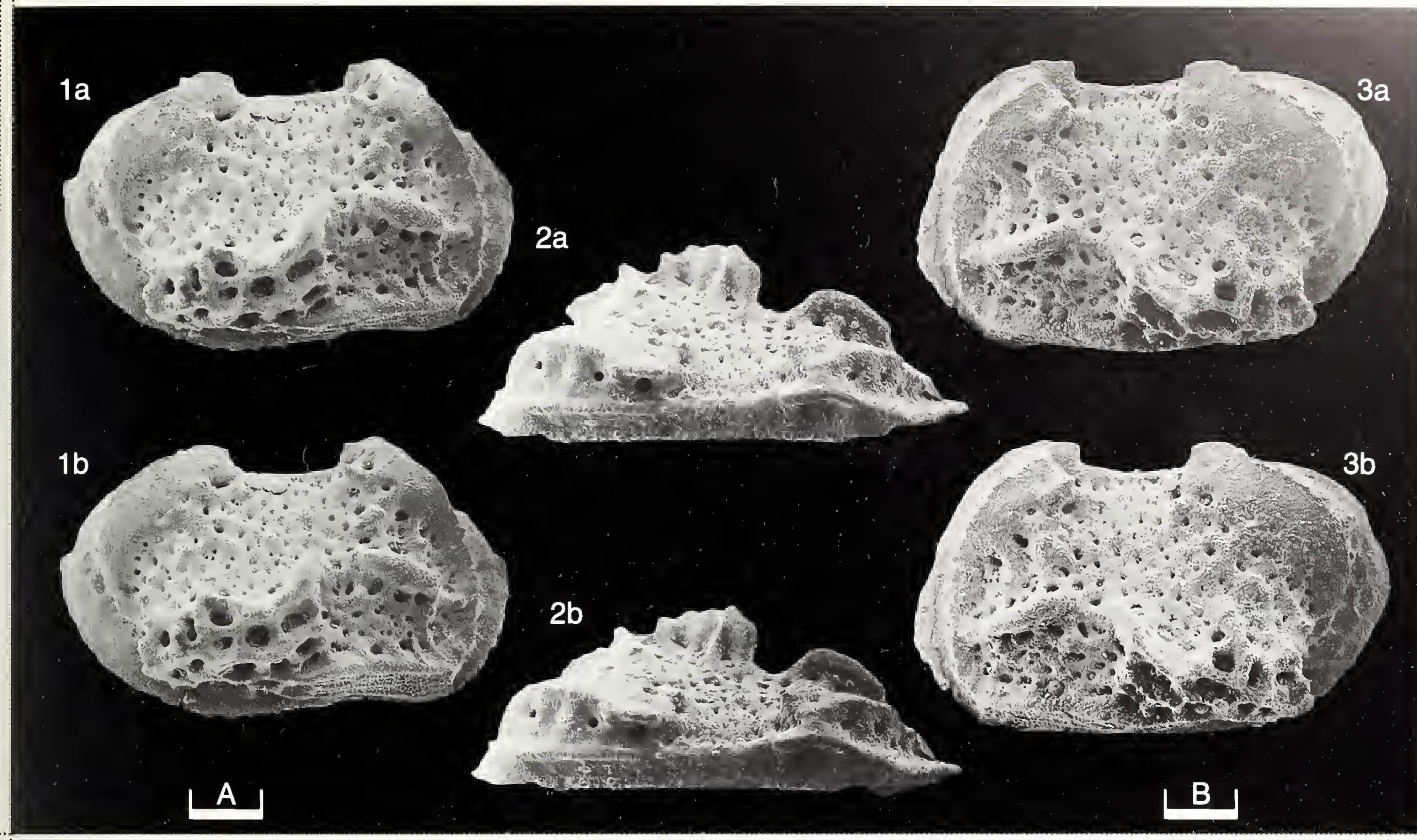
Diagnosis: A sub-ovate species of *Eucytherura* with well rounded anterior and posterior margins. The species is distinguished by the presence of anterior and postero-dorsal flanges, both of which project above the hinge line. The anterior and posterior margins are compressed. The lateral surfaces bear fine and medium sized reticulae. The carapace is inflated postero-ventrally bearing a raised box-type reticulation. A short oblique rib occurs anteriorly. The hinge has a large ovate posterior tooth in the right valve (anterior tooth missing in figured specimen Pl. **22**, 115, figs. 1, 3). The median element is robust and locellate with a marked thinning about the mid-length. The calcified inner lamella is of moderate width and fused throughout.

Remarks: The dorsal surfaces between the marginal flanges and hinge line bear a series of circular depressions. These appear to be much deeper features than the lateral depressions although they are not expressed internally.

Distribution: Known only from the Oligocene bathyal sediments of ODP Site 865, Mid-Pacific Mountains.

Explanation of Plate 22, 115

Figs. 1–3, adult RV (holotype, **OS 14854**, 310 μm long): fig. 1, int. lat.; fig. 2, dors.; fig. 3, hinge.
Scale A (50 μm; ×205), figs. 1, 2; scale B (50 μm; ×370), fig. 3.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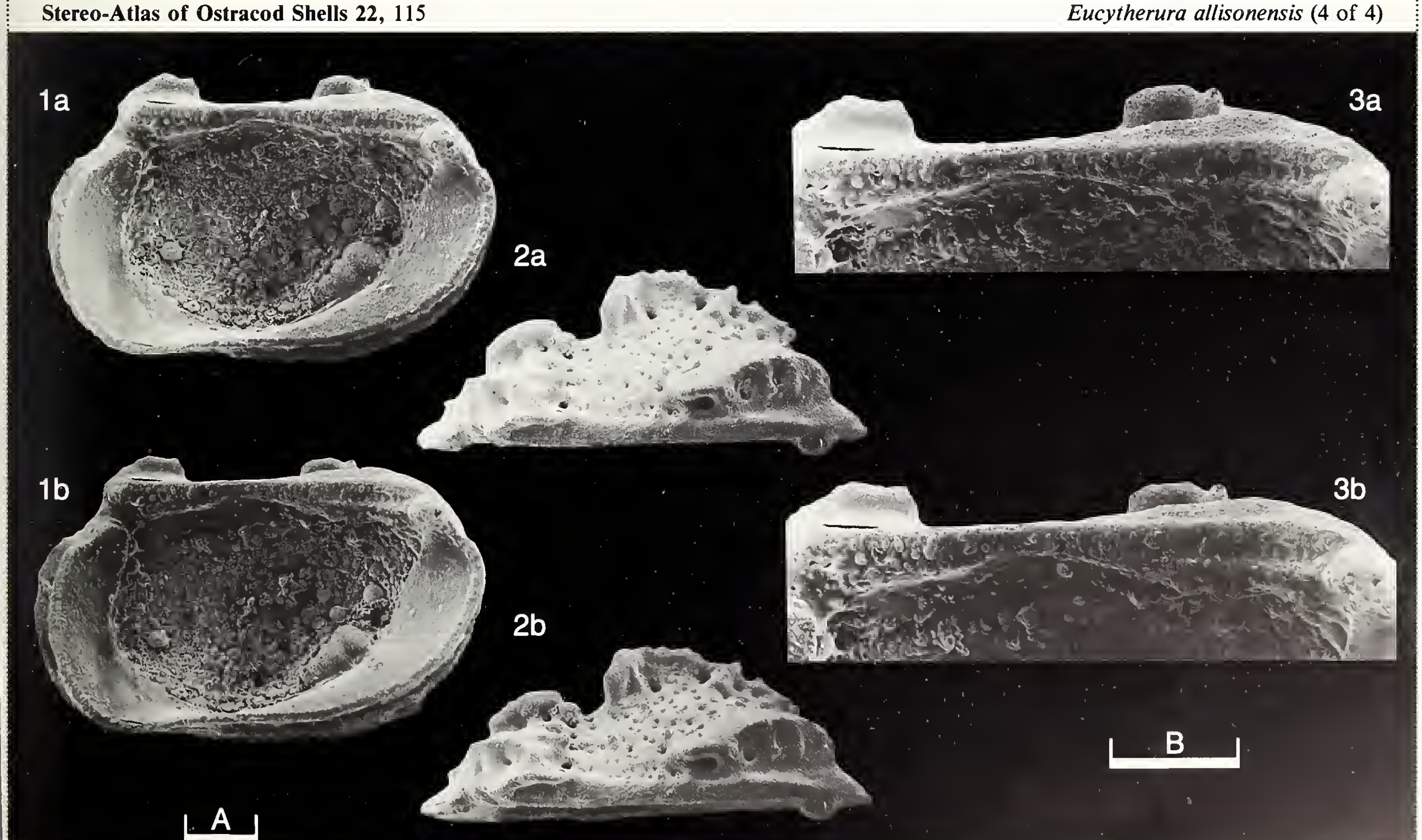
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A

595.337.14 (118.15) (265 : 162.180.18): 551.352 + 552.54

ON *HEMIPARACYTHERIDEA LARWOODI* BOOMER sp. nov.

by Ian Boomer
(School of Environmental Sciences, University of East Anglia, Norwich, England)

Hemiparacytheridea larwoodi sp. nov.

1995 *Hemiparacytheridea* sp. 14, I. Boomer & R. Whatley, *Proc. Ocean Drill. Prog. (Sci. Res.)*, **143**, pl. 4, fig. 17.

Holotype: The Natural History Museum, London ([BMNH] no. **OS 14850**, adult RV. [Paratype: no. **OS 14851**].

Type locality: Allison Guyot, Central Pacific Ocean. Ocean Drilling Program, Leg 143, Site 865B (lat. 18° 26.41′ N, long. 179° 33.33′ W), Core 2, section 5, 100–106 cm; Lower Oligocene.

Derivation of name: Dedicated to Mr. J. Larwood who first recorded this species during the course of his Ph.D. research.

Figured specimens: The Natural History Museum, London [BMNH] nos. **OS 14850** (holotype, RV: Pl. **22**, 117, figs. 1, 3; Pl. **22**, 119, figs. 2, 3), **OS 14851** (paratype, LV: Pl. **22**, 117, figs. 2, 4; Pl. **22**, 119, fig. 1).

Explanation of Plate 22, 117

Figs. 1, 3, adult RV, (holotype, **OS 14850**, 440 μm long): fig. 1, ext. lat.; fig. 3, dors. Figs. 2, 4, adult LV (paratype, **OS 14851**, 440 μm long): fig. 2, dors.; fig. 4, ext. lat.
Scale A (100 μm; ×157), figs. 1–4.

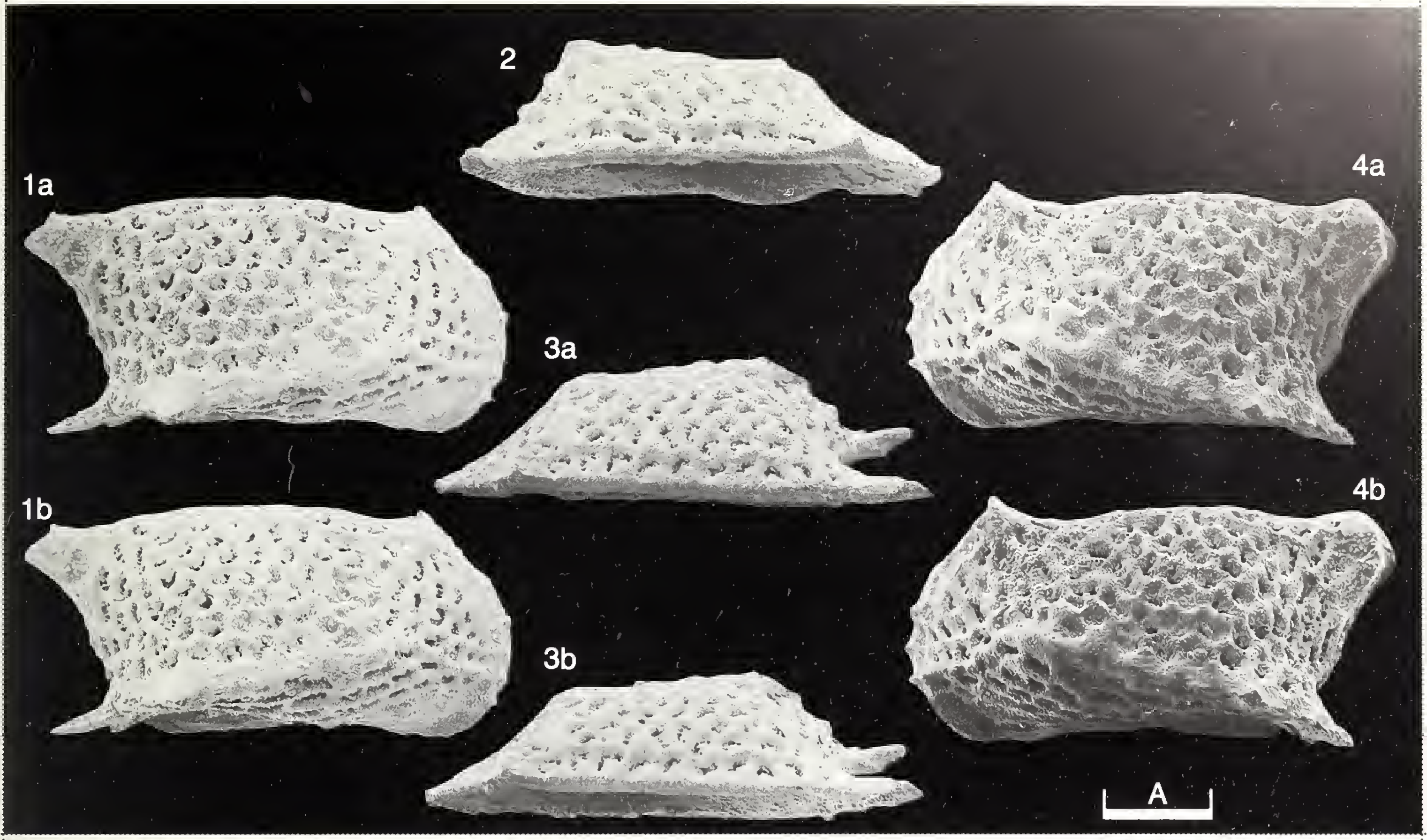
Diagnosis: The species is elongate, sub-rhomboidal in lateral view and is distinguished by an oblique ventro-lateral rib which marks the distal limit of a weak ventro-lateral inflation. The rib terminates posteriorly in a strong backward projecting spine. The lateral surfaces bear regular, sub-rounded reticulae which become elongate on the ventral surfaces. The anterior cardinal angle is distinctly acute in both valves, the caudal process is short and upturned at the postero-dorsal extremity. The hinge has a locelate median element which is expanded posterior!y, the terminal elements are much reduced. The marginal zone is broad and fused throughout.

Remarks: The genus is common in deep sea assemblages from Palaeocene to Recent. Despite its occurrence in the deep sea, the present species shows evidence of an occular sinus at the anterior cardinal angle. This feature must be redundant in the bathyal environment but alludes to the origin of this group in the photic zone.

Distribution: Known from Oligocene to Miocene bathyal sediments in the Pacific Ocean, ODP sites 865, 871, 872 (Mid-Pacific Mountains), DSDP Site 77 (Horizon Guyot) and DSDP Site 200 (Ita Mai Tai Guyot, Larwood pers. comm.).

Explanation of Plate 22, 119

Fig. 1, adult LV, int. lat. (paratype, **OS 14851**, 440 μm long). Figs. 2, 3, adult RV (holotype, **OS 14850**, 440 μm long): fig. 2, vent.; fig. 3, int. lat.
Scale A (100 μm; ×148), fig. 1; scale B (100 μm; ×157), figs. 2, 3.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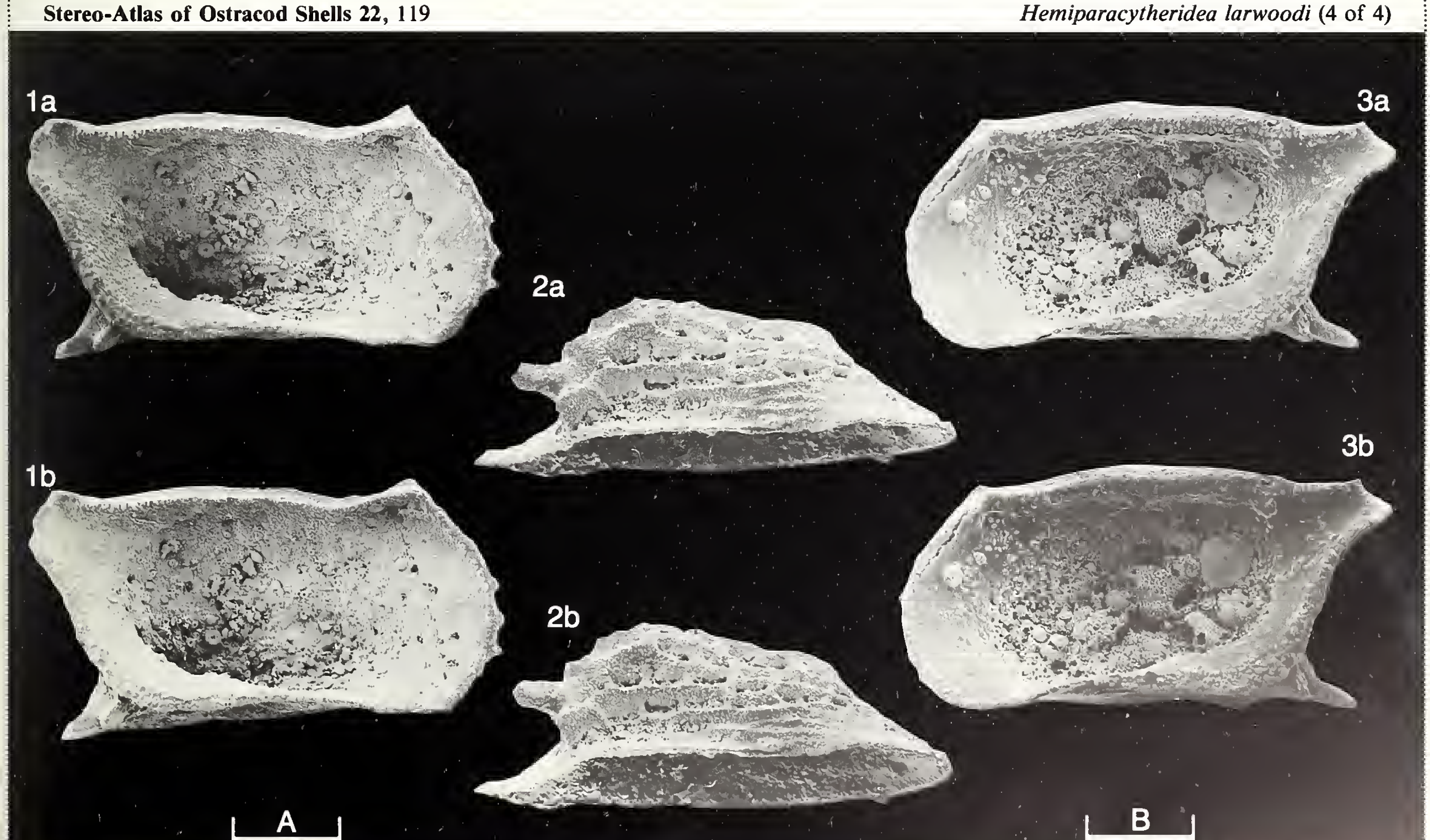
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595.337.14 (116.222) (411 : 162.007.56): 551.312 + 552.52

ON *LIMNOCYTHERE EIGGENSIS* WAKEFIELD nom. nov.

by Matthew I. Wakefield
(British Gas P.L.C., Gas Research Centre, Loughborough, England)

Limnocythere eiggensis nom. nov.

1994 *Limnocythere spinosa* sp. nov., M.I. Wakefield, *Palaeontogr Soc. (Monogr.)*, **148**, (593), 33–35, pl. 4, figs. 20–27.
non 1957 *Limnocythere spinosa* sp. nov., K.N. Negadaev-Nikonov, *Uchen. Zap. kishin. gos. Univ.*, **25**, 47–52.

Holotype: The Natural History Museum, London [BMNH], no. **OS 13832**: ♀ left valve.
[Paratypes: nos. **OS 13833–38**.]

Type locality: North Shore, Isle of Eigg, Scotland. National Grid Reference: NM 471 906 (lat. 56° 57′ N, long. 6° 10′ W). Type level is 5 cm above the base of Bed 8b of Hudson (*in*: Emeleus, C.H. (ed.), in press, *The Geology of Rum, and the Adjacent Islands*. Memoir for Sheet 60. British Geological Survey, London, HMSO), Lonfearn Member, Lealt Shale Formation, Great Estuarine Group, Middle Jurassic (Bathonian).

Derivation of name: After the type locality, Isle of Eigg, Inner Hebrides, Scotland.

Figured specimens: The Natural History Museum, London [BMNH] nos. **OS 13832** (holotype, ♀ LV: Pl. **22**, 121, fig. 1), **OS 13833** (paratype, A-2, LV: Pl. **22**, 121, figs. 3, 4), **OS 13834** (paratype, A-2, RV: Pl. **22**, 121, fig. 5, 6), **OS 13835** (paratype, ♂ LV: Pl. **22**, 121, fig. 2), **OS 13836** (paratype, A-1, LV: Pl. **22**, 122, figs. 6–8), **OS 13837** (paratype, A-2, RV: Pl. **22**, 122, figs. 1–5), **OS 13838** (paratype, ♀ RV: Pl. **22**, 121, figs. 7, 8).
OS 13832, **OS 13836** and **OS 13837** from type locality and horizon. **OS 13833**, **OS 13834**, **OS 13835** and

Explanation of Plate 22, 121

Fig. 1, ♀ LV, ext. lat. (holotype, **OS 13832**, 733 μm long). Fig. 2, ♂ LV, ext. lat. (paratype, **OS 13835**, 618 μm long). Figs. 3, 4, A-2 LV (paratype, **OS 13833**, 527 μm long): fig. 3, ext. lat.; fig. 4, dors. Figs. 5, 6, A-2 RV (paratype, **OS 13834**, 445 μm long): fig. 5, ext. lat.; fig. 6, dors. Figs. 7, 8, ♀ RV (paratype, **OS 13838**, 691 μm long): fig. 7, ext. lat.; fig. 8, dors.
Scale A (100 μm; ×70), figs. 1, 2, 7, 8; scale B (100 μm; ×90), figs. 3–6.

OS 13838 from 20 cm above base Bed 7, Lonfearn Member, Lealt Shale Formation, Great Estuarine Group, Rudha nam Braithairean, Trotternish, Skye (Wakefield, 1994, *op. cit.*).

Diagnosis: Carapace subrectangular in lateral view with strongly developed ventrolateral alae. Hemispherical swelling developed posterior of alar projection. At least eight anterior and two posterior marginal pore canals present (after Wakefield, 1994, *op. cit.*).

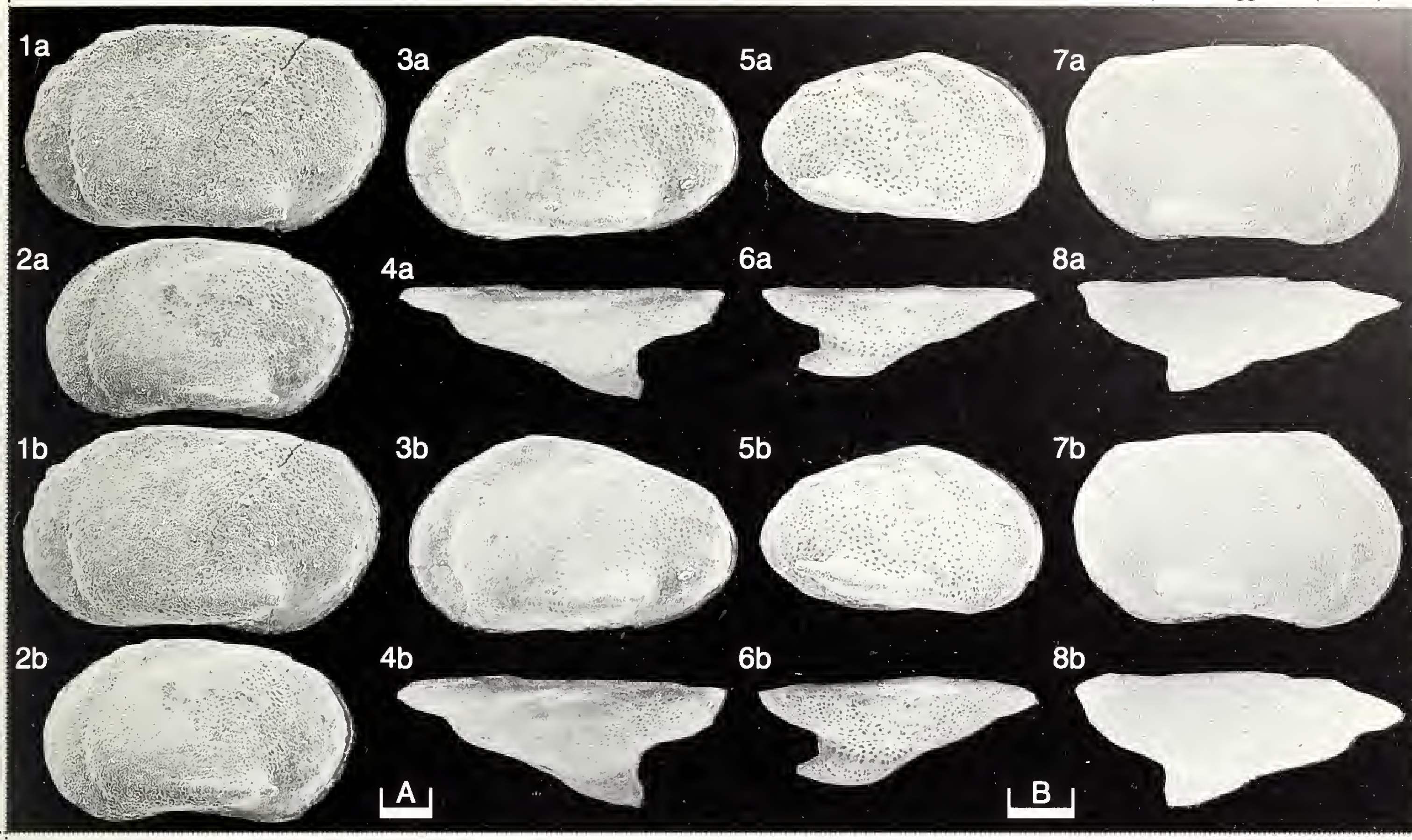
Remarks: Posteroventral hemispherical swelling variably developed, or may be absent. Male illustrated herein (**OS 13835** Pl. **22**, 121, fig. 2) is one of the smallest recovered. Outline of alae in dorsal view variable due to preservation. The strongly alate nature of *L. eiggensis* prompts questioning of its generic assignment, extant species of the genus usually possess only weakly developed alae. *L. eiggensis* bears some similarities to *Limnicytheropteron* Swain, 1986 (*Revta esp. Micropaleont.* **18**, 100–102, Pl. 4, figs. 10, 11 & 15; Pl. 5, figs. 4–16), however, the present species clearly differs in being avesibulate, in possessing a distinctly compressed anterior marginal zone, and in being dorso-medianly sulcate. None of the *Limnocythere* species described by Martens, 1990 (*Arch. Hydrobiol.*, Suppl. **83**, 543–524) possess ventro-lateral alae, though many do have a tubercle developed in the same position as the alae in *L. eiggensis* i.e. ventro-laterally above the ventral inflexure. Delorme 1971 (*Can. J. Zool.* **49**, 43–64) describes several *Limnocythere* species which possess ventro-lateral alae above the ventral inflexure, though well developed, these features are not as large as in *L. eiggensis*. There is clearly great variability in alar development within the genus and to omit the present species from *Limnocythere* purely on the development of this feature is not valid. The generic diagnosis of *Limnocythere* should be amended to include the development of alae.

Distribution: Known only from the Middle Jurassic (Bathonian) Lonfern Member, Lealt Shale Formation, Great Estuarine Group, Inner Hebrides, Scotland.

Acknowledgement: NERC and BP for CASE Award GT4/88/GS/62 held in the Department of Geology, Leicester University, England (1988–91). The latter is thanked for the use of its darkroom facilities during the preparation of this paper.

Explanation of Plate 22, 123

Fig. 1–5, A-2 LV (paratype, **OS 13837**, 509 μm long): fig. 1, int. lat.; fig. 2, musc. sc.; fig. 3, oblique int. ant.; fig. 4, dors.; fig. 5, oblique int. post. Figs. 6–8, A-1 LV (paratype, **OS 13836**, 636 μm long): fig. 6, post.; fig. 7, vent.; fig. 8, ext. lat.
Scale A (100 μm; ×90), figs. 1, 4; scale B (50 μm; ×350), fig. 2; scale C (100 μm; ×125), figs. 3, 5; scale D (100 μm; ×80), figs. 6–8.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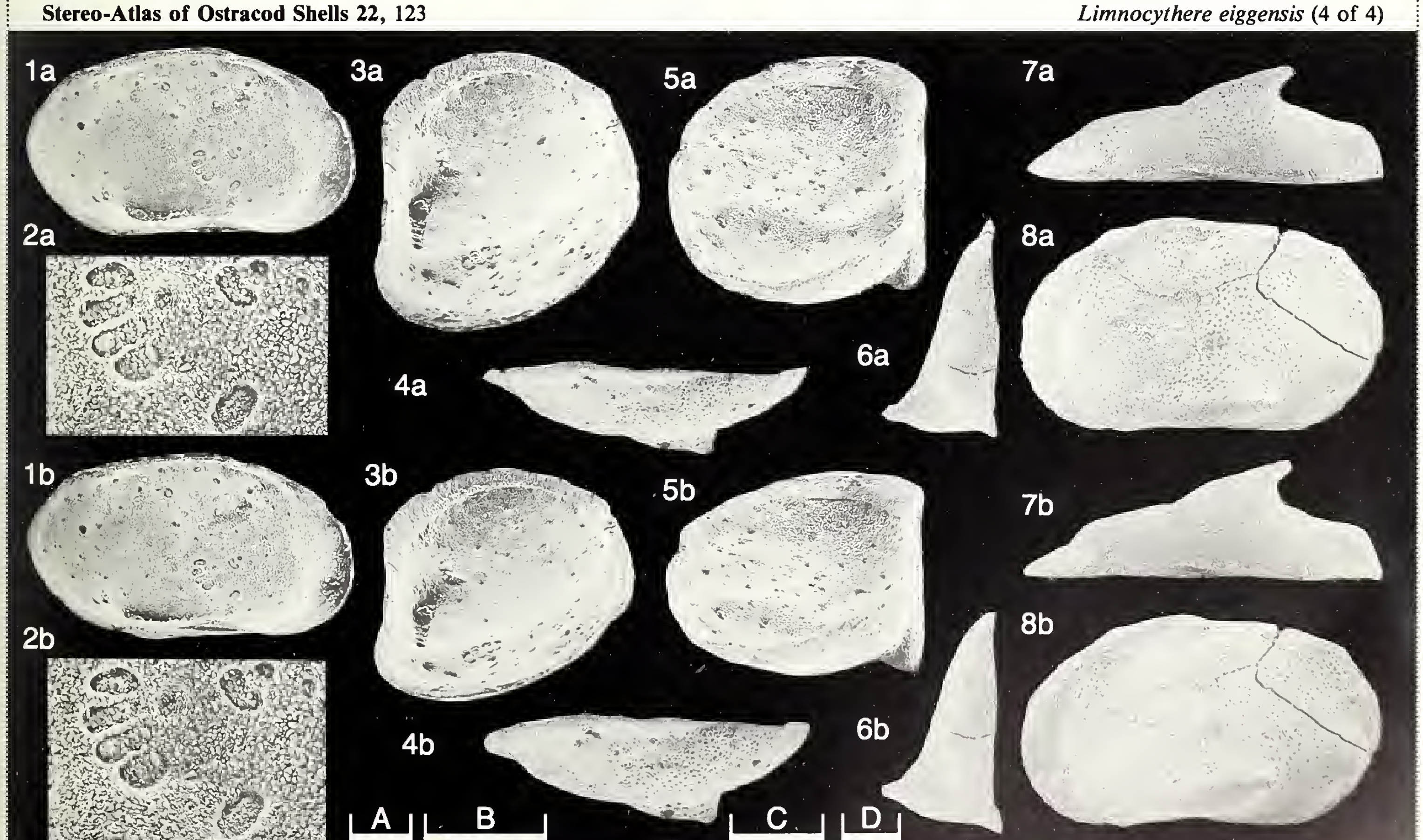
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General Index

Index; Geological Horizon

See **1** (1) 5–22 **(1973)** for explanation of the Schedules in the Universal Decimal Classification

Index; Geographical Location

See **1** (1) 5–22 **(1973)** for explanation of the Schedules in the Universal Decimal Classification

Stero-Atlas of Ostracod Shells: Vol. 22, Part 2

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